

MBL/WHOI



0 0301 0051528 4

DEPARTMENT OF TERRESTRIAL MAGNETISM
J. A. Fleming, Director

Scientific Results of Cruise VII of the CARNEGIE during 1928-1929
under the Command of Captain J. P. Ault

BIOLOGY—I

The Copepods of the Plankton
Gathered During the Last Cruise
of the CARNEGIE

CHARLES B. WILSON



CARNEGIE INSTITUTION OF WASHINGTON PUBLICATION 536
WASHINGTON, D. C.

1942



DEPARTMENT OF TERRESTRIAL MAGNETISM
J. A. Fleming, Director

Scientific Results of Cruise VII of the CARNEGIE during 1928-1929
under the Command of Captain J. P. Ault

BIOLOGY—I

The Copepods of the Plankton
Gathered During the Last Cruise
of the CARNEGIE

CHARLES B. WILSON



CARNEGIE INSTITUTION OF WASHINGTON PUBLICATION 536
WASHINGTON, D. C.

1942

Captain W. J. Peters laid the broad foundation of the work during the early cruises of both vessels, and Captain J. P. Ault, who had had the good fortune to serve under him, continued and developed that which he had so well begun. The original plan of the work was envisioned by L. A. Bauer, the first Director of the Department of Terrestrial Magnetism, Carnegie Institution of Washington; the development of suitable methods and apparatus was the result of the painstaking efforts of his co-workers at Washington. Truly, as was stated by Captain Ault in an address during the commemorative exercises held on board the *Carnegie* in San Francisco, August 26, 1929, "The story of individual endeavor and enterprise, of invention and accomplishment, cannot be told."

Dr. Charles Branch Wilson, the last of that outstanding group of great monographers of the marine copepods which included Brady, Dana, Giesbrecht, Sars, and Thomas and Andrew Scott, died August 18, 1941. Thus the printing of this report on the copepods gathered on cruise VII of the *Carnegie* could not have his supervision. We are indebted to Dr. Waldo L. Schmitt, Curator of the Division of Marine Invertebrates of the United States National Museum, and his associates for certain necessary additions to the manuscript, for reading it, and for clearing up a few questions raised in the editorial revisions by the Office of Publications of the Institution and by Mr. C. C. Ennis of the Department of Terrestrial Magnetism.

All Dr. Wilson's records and his very complete library of copepod literature were bequeathed to the Division of

Marine Invertebrates, United States National Museum, Washington, D. C. It is hoped that the recipients of this posthumous work of Dr. Wilson's will continue to contribute any publications of their own dealing with copepods or marine biology to the Wilson library at the National Museum, in order that it may be kept as up to date as possible.

It is fitting to quote here Dr. Schmitt's appraisal of this memoir in an obituary notice, where, in referring to the three major manuscripts written by Dr. Wilson during the last decade, he says of this one: "It, perhaps the most important in Dr. Wilson's own opinion, deals with the copepods of the marine plankton taken on the last cruise of the ill-fated nonmagnetic yacht *Carnegie*. This report, which was submitted for publication several years ago, for the first time in the history of oceanography gives the directly comparable results of simultaneous three-level tows made in all oceans with identical gear, accompanied by full station data, including temperature, salinity, density, phosphates, and hydrogen-ion concentration. In his painstaking tabulation of the species of copepods in every haul and their abundance at each of the three levels investigated, involving the microscopic inspection of many thousands of individual copepods, Dr. Wilson has made available a biologic record of a group of organisms of highest importance in the economy of the seas such as has never been achieved by any marine expedition."

J. A. FLEMING

Director, Department of Terrestrial Magnetism

CONTENTS

	PAGE		PAGE
INTRODUCTION	1	Diversity of Distribution	8
APPARATUS AND METHODS	1	Daytime Stratification	8
Nets	1	Causes of Daytime Stratification	9
Localities	2	Temperature	9
Depth of Tow	2	Salinity (Map 3) and Density	11
Time of Tow	2	Hydrogen-Ion Concentration	11
Volume of Tow (Pacific Stations Only)	2	Phototropism	11
QUALIFYING CONDITIONS	2	LISTS OF SPECIES BY STATIONS	15
Nets	2	DISCUSSION OF SPECIES (Alphabetically Arranged)	169
Depth of Tow	4	LITERATURE CITED	211
Supplementary Data	4	LIST OF SPECIES DISCUSSED	215
Oceanic Currents	4	FIGURES 1-136	218
COMPARISONS OF PLANKTON	5	INDEX	235
Comparison of the Two Oceans	5		
Comparison of Different Regions of the Pacific	7		

77504

THE COPEPODS OF THE PLANKTON GATHERED DURING THE LAST CRUISE OF THE CARNEGIE

INTRODUCTION

During cruise VII, 1928-1929, of the nonmagnetic vessel *Carnegie* extensive collections of plankton were made over parts of the Atlantic Ocean north of the equator and of the Pacific Ocean from 52° north latitude to 40° south latitude.

The present paper deals only with the copepods of this plankton, their identification, and their actual and relative distribution. In order to facilitate a correct interpretation of the records herewith presented, a preliminary account is given of the apparatus and methods employed. Certain qualifications also, which materially influence

the conclusions to be drawn from the records, are discussed somewhat at length. By this means, it is hoped that whatever might otherwise prove to be erroneous or illogical may be removed so that the ultimate conclusions may become rational, trustworthy, and instructive.

The following four species and the first two genera are here described for the first time:

- Carnegiella gracilis*, new genus and new species, page 176
Danodes plumata, new genus and new species, page 182
Onchocalanus nudipes, new species, page 199
Scolecithricella spinacantha, new species, page 208

APPARATUS AND METHODS

NETS

The townets used on the *Carnegie* were the ordinary conical one-meter and half-meter nets of fine-meshed bolting silk. These were reinforced in the usual manner with canvas at either end and with both circular and longitudinal ribs of stout tape in the space between the canvas ends. The same nets were used throughout the entire cruise and always in the same manner, to insure a uniform basis of comparison between the different tows. These nets could not be closed, but remained wide open while being lowered to and raised from the 50-meter and 100-meter levels. They were carefully cleaned after every towing so that there should be no mixing of species from different stations.

[The following description of the nets used on the *Carnegie* is from H. R. Seiwel's article "Patterns for conical silk plankton nets of one-meter and half-meter diameters" as published in *Jour. Conseil Internat. Explor. Mer*, vol. 4, pp. 99-103 (1929).—Ed.]

The nets are of sizes (a) one-meter diameter and 4½ meters long (the *Michael Sars* net), and (b) one-half meter diameter and 2¾ meters long. Both were made from silk bolting-cloth of different meshes with canvas-collars at the top and bottom to hold the net-ring and collecting bottle, respectively. The nets (a) were made in three different meshes and the nets (b) in two different meshes since the filtering characteristics of a net must be according to the kind of plankton to be collected.

Dufour silk bolting-cloth of sizes 0000(XX), 0(XX), 2(XX), 5(XX), 10(XXX), and 15(XXX) was used exclu-

sively for the filtering surface, and eight-ounce double-filled, white, extra duck for the canvas-collars. The seams were taped with inch-wide, fine woven linen or cotton tape, and the silk was sewed with the best quality No. 0 machine twist-silk thread. Fine woven cotton tape 1½ inches wide was used for the three-meter horizontal seam which also served to hold the small brass rings to guide the throttle-line. One-inch pearl buttons of good quality were sewed with a strong linen thread to the double canvas-collar, all button holes being machine-made.

The one-meter (outside diameter) brass rings for nets (a) were made of three-quarter-inch rod and the half-meter (outside diameter) brass rings for nets (b) of half-inch rod. The silk pieces were joined together by a one-inch French seam, which was taped on the outside and held in place by two additional rows of stitching. . . .

Three sizes of silk were used in making the *Michael Sars* net one meter in diameter at the mouth, tapering to a diameter of 0.10 meter, and 4.5 meters long, in the following combinations.

Section	Combination		
	1	2	3
(1) Upper, 0.5 meter long . . .	0000(XX)	0000(XX)	0000(XX)
(2) Middle, 1 meter long . . .	10(XXX)	5(XX)	0(XX)
(3) Lower, 3 meters long . . .	15(XXX)	10(XXX)	2(XX)

Two sizes of silk are used in the one-half meter net which is one-half meter in diameter at the mouth, tapering to a diameter of 6 cm, and has length of 2.75 meters. . . . These nets were used in the following combinations: (1) upper section of length 0.75 meter made of silk bolting-cloth of size 5(XX) and the lower section 2.0 meters long of size 10(XXX); (2) the upper section of length 0.75 meter made

of silk bolting-cloth of size 10(XXX), and the lower section 2.0 meters in length of size 15(XXX).

LOCALITIES

Tows were taken at each of the 162 stations designated on the accompanying map (map 1), though tows at only 158 regular stations were considered.¹ Enough others were taken between the stations to bring the total of the localities up to 208. Not including 3 localities in the North Sea, only 39 of these localities are in the Atlantic Ocean, the remaining 166 being in the Pacific Ocean. As a result the Pacific is well covered from 52° north latitude to 40° south latitude, but in the Atlantic the stations are all north of the equator. This disparity was not intentional, but was due to the unfortunate destruction of the *Carnegie* at the close of the first half of her cruise. The second half of the cruise had been planned to include the southern part of the Pacific between 40° and 60° south latitude, the South Atlantic from the equator to 60° south latitude, and the entire Indian Ocean. This would have furnished data of supreme value for a comparison of the plankton of the three oceans. It is fortunate that, in accordance with the *Carnegie's* rule to forward immediately to Washington at each port of call all accumulated data and collections, no data or plankton collections were lost at Samoa in the destruction of the vessel.

DEPTH OF TOW

At each of the regular stations three tows were taken, one at the surface, a second at 50 meters, and a third at 100 meters. The second and third nets were attached to the same wire; the surface net was on a separate wire, but was towed simultaneously with the other two. All the nets were drawn horizontally for a sufficient distance

to obtain an excellent sample of the plankton at each of the three depths. The length of the tow varied considerably and is recorded for the Pacific stations only (pp. 42-168). All the tows between the regular stations, with one or two exceptions, were taken at the surface only when the vessel slowed down sufficiently or was becalmed. No vertical tows were made, with the single exception of one at station 64, and this was also the only one below 100 meters in depth.

TIME OF TOW

All the tows at the regular stations were started at 8^h30^m A.M. local mean time, the time of completion varying with the length of the tow. Thus they were all daylight tows taken at about the middle of the forenoon, and none taken during the afternoon, evening, or night. This regularity of the time of the tows adds greatly to their value for purposes of comparison.

The surface tows between stations, being dependent on the slowing down or becalming of the vessel, never came regularly but were taken at any time during the twenty-four hours, most often at night. They thus supply valuable data with reference to the migration upward of certain species of copepods during the night.

VOLUME OF TOW (PACIFIC STATIONS ONLY)

The volume of the tow was computed by allowing it to settle to the bottom of the bottle and measuring its depth. However deficient this method may be with reference to the actual bulk of the plankton, it does supply a reliable basis of comparison when followed uniformly. When considered in connection with the length of the tow, it furnishes an accurate estimate of the comparative richness of the plankton in any locality.

QUALIFYING CONDITIONS

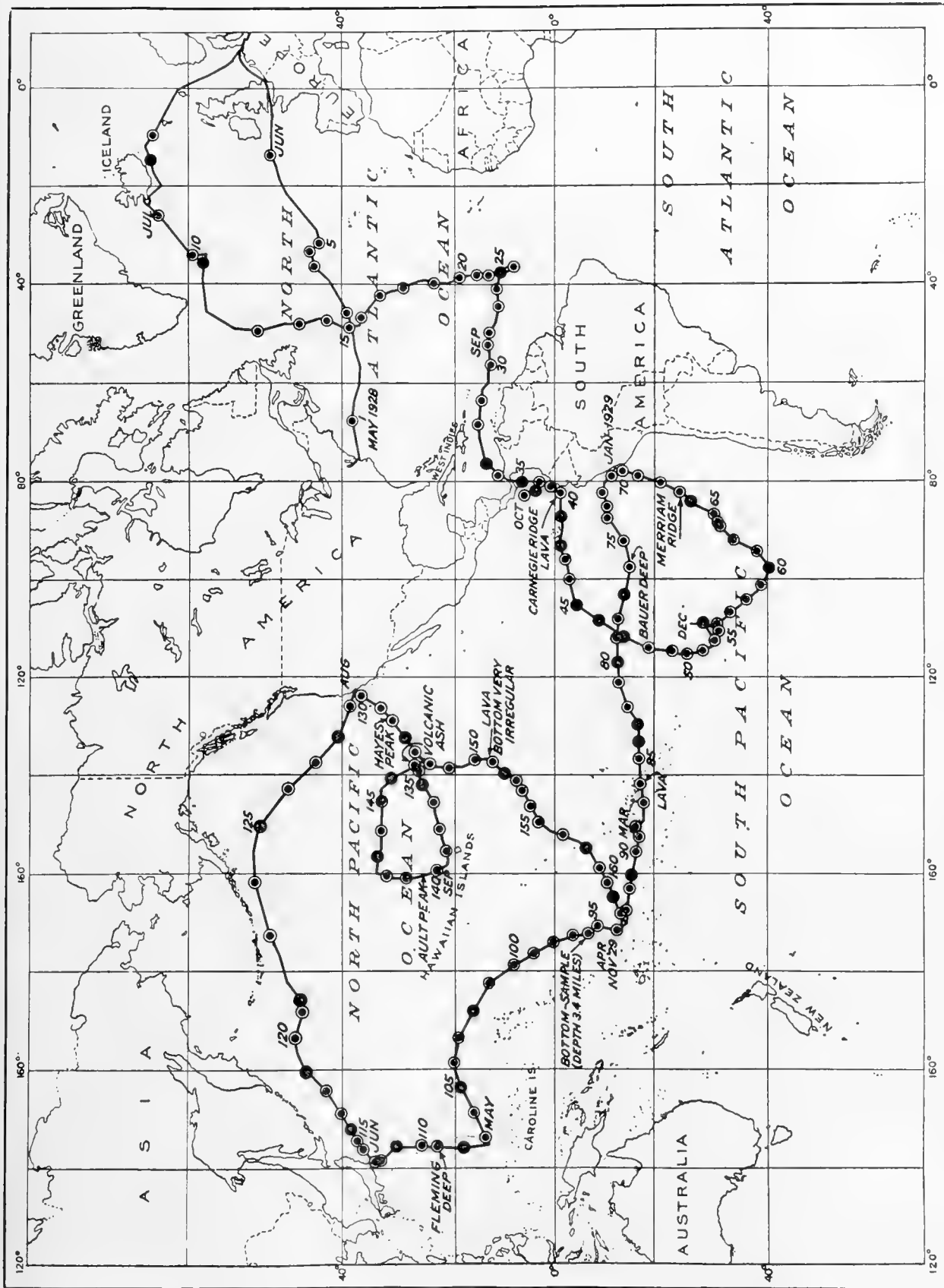
NETS

It is stated above that the nets used in the 50- and 100-meter tows could not be closed while being lowered and raised. In other words, these two deeper tows were not exclusively horizontal, but included also a vertical or diagonal tow to the surface. This means that copepods could get into them at levels nearer the surface than the recorded depth of the tow.

In all probability such intrusion of individuals from a

different level actually occurred more or less frequently. But the percentage of these aliens is small, as can be seen by the number of species in each station list recorded exclusively from the two upper levels. Any species confined to the 50- or 100-meter level would not be affected by other species coming in from higher levels. But if even one or two specimens of a species which was really confined to the surface got into the 50- or the 100-meter net, it would indicate the presence of that species at a level where it did not really occur. The comparatively small percentage of species found at all three levels and the comparatively large percentage of species confined to a

¹ For stations 129, 131, 161, and 162, apparently Dr. Wilson did not find any material for this report.—Ed.



Map 1. Oceanographic stations, cruise VII of the *Carnegie*, 1928-1929

single level are good proof that the mixing of different levels was rare. The relative abundance of any species at different levels will also prove helpful in deciding where it really belongs. For example, suppose a species is sufficiently abundant at the surface to constitute 80 or 90 per cent of the surface tow, as sometimes occurred, and only one or two specimens are found in the tows at lower levels. It is reasonable to infer that the latter specimens do not really belong to the deeper tow, but entered while the net was being raised or lowered. There will necessarily be some mixing of levels, but it is so slight as to be practically negligible, and none of the important results here considered is at all affected by it.

DEPTH OF TOW

Since the lowest depth at which tows were taken (with one exception) was 100 meters, whereas the depth of the bottom at all but 5 of the stations ranged from 2000 to 8000 meters, it follows that the entire towing was practically at the surface. We are concerned here, therefore, with the epiplankton exclusively, and not at all with the bathyplankton. This means that the range of the species here recorded must be regarded as essentially a surface-area distribution, and only incidentally as a depth distribution. This consideration is of special importance in comparing the present records with those of other expeditions, notably the *Challenger*, *Siboga*, and bathypelagic Monaco expeditions. It is obvious that none of the numerous rare and often unique species obtained at depths ranging from several hundreds to even thousands of meters can be expected in these surface tows. Their absence from these records, therefore, is no indication that they were not present at the localities examined, but simply that the nets did not descend far enough to secure them. On the other hand, the presence in these tows of certain species obtained by other expeditions in vertical tows starting from considerable depths shows that such copepods cannot be regarded as exclusively bathypelagic.

The *Siboga* expedition yielded the largest total of species thus far recorded. But at every station of that expedition whose record of species totaled above 70, the towing was done with a Hensen vertical net starting from depths of 700 to 2000 meters. These same deep vertical tows included most of the new species that were obtained. In view of these considerations, the facts that the *Carnegie* stations from 35 to 44 inclusive averaged 83 species, and that several other stations yielded species totals of from 90 to over 100, assume a greatly enhanced significance. These facts should be kept constantly in mind also when comparing the *Carnegie* records with those of the *Challenger*, *Siboga*, and Monaco expeditions.

SUPPLEMENTARY DATA

In the station lists of species herewith presented there are included statistics regarding certain factors which have considerable significance in copepod distribution. The Carnegie Institution of Washington has furnished the author with blueprint lists showing the temperature, salinity, density, and hydrogen-ion concentration of the sea water at the three tow depths for each station. These data are reproduced here, but those pertaining to conditions of the weather, sky, and sea at the various oceanographic stations are not given in this report inasmuch as they are to be published in other volumes of this series giving the observed data and discussions relating to physical oceanography and to meteorology. A second blueprint list supplies for the Pacific stations (35 to 162) the total volume of the plankton for each of the tows and the distance through which the net was drawn to secure that volume. The data for volume and distance are not available for the 34 Atlantic stations except in one or two instances.

The lists of copepod species from the three tows at each station have been kept separate, and there is also recorded the comparative abundance of each species at the three depths.

All these data are incorporated in each station list because it is believed that they are fully as valuable as the lists of species themselves. As far as is known, such data have never before been presented in connection with station lists. They furnish practically all the information that can be obtained with reference to each locality. Without them the list is devoid of any information except the mere names, and becomes practically meaningless.

OCEANIC CURRENTS

The surface currents of both the Atlantic and Pacific oceans were fairly well known and had been charted before this cruise of the *Carnegie*. The observations taken during the present cruise confirm previous discoveries and add a great many of the missing details. Very much less is known about the deep-sea currents, but since all the *Carnegie* tows were confined to the upper 100 meters of water, these deeper currents would not affect them so much as would those at the surface. The thing that concerns us most in dealing with the copepods is the evidence of an intimate relation between the surface currents and plankton distribution.

The only surface current of any importance in the North Atlantic is the well known Gulf Stream. This was crossed several times by the *Carnegie*, and its influence was chiefly manifested in an increase of the copepod plankton, both in species and in numbers. There were

also some of the usual instances of a northward transportation of species whose normal habitat was farther to the south. The course of the *Carnegie* in the Atlantic did not come in contact with other surface currents, and consequently the station lists of copepods cannot give us more than this minimum of evidence with reference to the influence of the currents on the plankton. A similar relation between the Gulf Stream and the volume of the plankton was shown by Jespersen (1926) in his discussion of the quantity of macroplankton in the North Atlantic, but species were not mentioned.

In the Pacific Ocean, however, conditions are very different. In one of the papers already published by the Carnegie Institution of Washington, Sverdrup has made use of the map of the surface currents of the Pacific which is here reproduced (map 2). This map shows an approximately symmetrical surface circulation north and south of the thermal equator, which is a few degrees north of the geographic equator. In the South Pacific the west-wind drift generates a current flowing east and striking the western coast of South America, where it is deflected to the north along the coast as the Peruvian Current. At the equator this current is turned back westward across the central Pacific as the South Equatorial Current. A part of it flows directly west to the East Indies, another part flows southwest to Australia.

In the North Pacific the west-wind drift forms the Japan Current, which flows eastward and, striking the western coast of North America, is deflected to the south as the California Current. This follows the coast to the southern boundary of Mexico, where it is turned westward as the North Equatorial Current; this flows directly west to the Philippine Islands, where it joins the Japan

Current. Between the two equatorial currents, both of which flow west, is a countercurrent flowing east along the thermal equator and striking the western coast of Central America. Here it divides, one half turning south and then west and joining the South Equatorial Current, the other half turning north and west and joining the North Equatorial Current.

The course of the *Carnegie* followed part of each of these currents. Stations 35 to 40 were in the half of the eastern end of the Counter Equatorial Current that turns south and west. Stations 40 to 80 were within or close to the Peruvian Current. Stations 93 to 98 were in the South Equatorial Current. Stations 102 to 110 were in the North Equatorial Current. Stations 111 to 115 were in the Japan Current. Stations 128 to 135 were in the California Current. Stations 150 to 160 crossed the North and South Equatorial and the Counter Equatorial currents.

The above stations in every instance were the ones that yielded the greatest variety of copepod species and the largest number of individuals. There must be something, therefore, in connection with these currents which is conducive to copepod life and development.

Sverdrup has plainly shown a combination of low salinity and low temperature near the surface in the Peruvian Current, and this combination appears to a greater or lesser degree in each of the other localities mentioned above. We cannot escape the conclusion that such a combination is favorable to the copepods, or at least not antagonistic. There is also the probability of better aeration of the water in these currents than outside of them, and the possibility that they contain a richer and more uniform supply of food than can be found in water that does not flow.

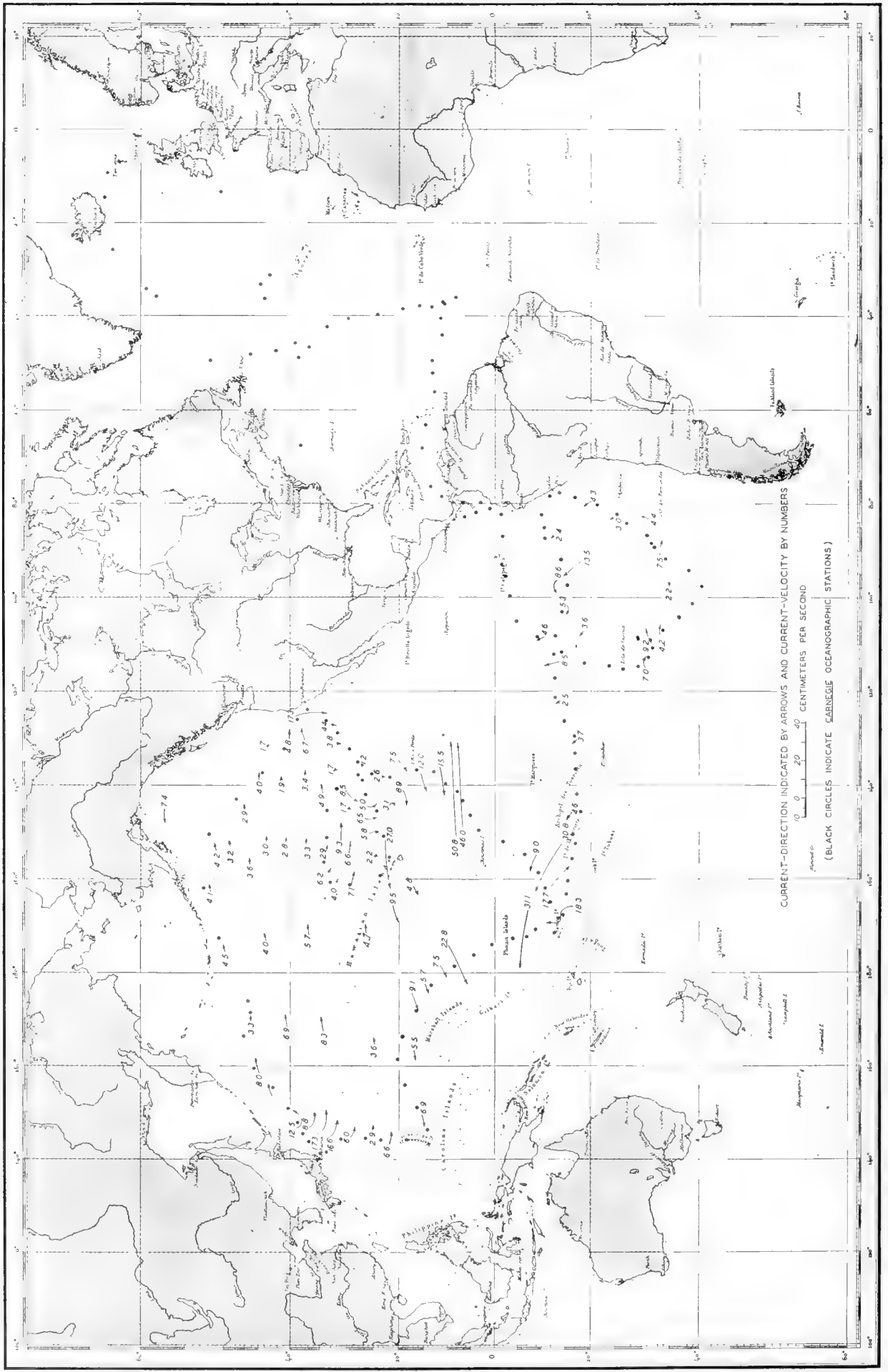
COMPARISONS OF PLANKTON

Since all the regular tows were made at the same time of day, by the same persons, using the same nets, and employing the same methods, the species lists will be as free from diversity as they could possibly be. If we combine with these lists of species the supplementary data mentioned above, we find ourselves in possession of an accurate and really scientific basis for a comparison of the copepod plankton of the two oceans and of the different parts of each of them.

COMPARISON OF THE TWO OCEANS

The *Carnegie* tows show that the Pacific plankton is much richer in copepod species than that of the Atlantic over those parts of the two oceans covered by the cruise. For instance, station 34, the last one in the

Atlantic, may be compared with station 35, the first one in the Pacific. These two stations are about equally distant from the two ends of the Panama Canal; the bottom depths are each over 3500 meters, with a difference of only 47 meters. The Atlantic station yielded 48 species; the Pacific station yielded 96 species. On comparing stations 15 to 25, down through the center of the North Atlantic, with stations 130 to 135 and 148 to 152 at corresponding latitudes in the Pacific, we get a total of 394 species for the Atlantic stations with an average of 36 per station, and 661 species for the Pacific stations with an average of 66 per station. Unfortunately the total volume of the plankton is not recorded for the Atlantic stations, but in view of the great inferiority in number of species it is reasonable to assume that it was much less than that at the Pacific stations.



MAP 2. Surface currents of the Pacific Ocean

The largest number of species at a single station in the Atlantic was 60, at station 23, and half the stations had each a total of less than 25 species. Pacific station 56 yielded 108 species; 14 stations yielded 80 to 96 species each, and 17 stations from 71 to 78 species each. At only 15 (12 per cent) of the 124 Pacific stations did the species total fall below 25. The entire number of different species obtained from all the Pacific stations was 265, whereas the Atlantic stations yielded only 132. Thus in the *Carnegie* tows the Pacific yielded, on the whole, 100 per cent more copepod species than the Atlantic.

But there are some excellent reasons why this ratio, although it is entirely correct for the *Carnegie* material, should not be too hastily adopted as true for the entire plankton of the two oceans. In the first place, only a part of the North Atlantic was covered by the *Carnegie* tows. If the North and South Atlantic had been as completely towed as were the North and South Pacific, the result would certainly have been different. In other words, the comparison is only a partial one. In the second place, the cruise of the *Carnegie* covered those parts of the Pacific which have been found by other investigators to be most prolific in copepod species. On the contrary, the parts of the North Atlantic that were included are regarded as the least prolific by all who have investigated the Atlantic plankton. The comparison, therefore, not only is incomplete, but also favors the Pacific to a considerable degree. Jespersen (1926), in discussing the quantity of macroplankton obtained in the Atlantic by Danish investigators, concluded that the minimum volume in the upper 100 meters was to be found in the western Atlantic between 20° and 30° north latitude, in the Caribbean Sea, and in the Sargasso Sea. The last two are the parts traversed by the *Carnegie*, which did not touch the regions of maximum volume. Jespersen stated that around the Azores the volume of plankton was 20 to 30 times as large as in the Sargasso Sea. If the region of the Azores, therefore, and other more prolific regions of the Atlantic had been included in the cruise of the *Carnegie*, the comparison of the plankton of the two oceans would have been much less favorable to the Pacific. In the third place, as has already been shown, more than half the Pacific stations came within the influence of surface currents, whereas only a few of those in the Atlantic were so situated. If these currents are really as conducive to copepod plankton as they appear to be, this is another advantage for the Pacific.

All these reasons are well worthy of consideration, but in spite of them it does not seem as if the inclusion of the more prolific parts of the Atlantic would produce enough additional species to take away the supremacy established by the *Carnegie* material for the Pacific. In looking for an explanation of the small number of species

found in the Sargasso Sea and in the Caribbean Sea, we may note that at the stations which are compared above we find in the Atlantic a comparatively high temperature combined with an exceptionally high salinity. A high salinity is known to be adverse to ordinary pelagic copepods, and it is possible that when combined with a fairly high temperature it may become a deterrent to copepod life in the euplankton.

It is worthy of comment that there was not found in the Pacific any trace of such countless swarms of a single copepod species as are often seen of *Calanus finmarchicus* at certain seasons in the North Atlantic. They may exist in the Bering Sea north of the Aleutian Islands, but this region was not visited by the *Carnegie*.

COMPARISON OF DIFFERENT REGIONS OF THE PACIFIC

Although the *Carnegie* tows thus are inadequate for a satisfactory comparison of the plankton of the two oceans, they do furnish an ideal basis for comparing the copepod faunas of the different regions of each ocean, especially of the Pacific. They are extensive enough to include adequate samples from practically all the important regions of the ocean, and at the same time they furnish enough data with reference to the environment in each of the regions to explain the differences that appear.

As has been found by all other investigators, the tropical parts of the ocean are richer in species than the temperate regions, but the tow is often inferior in volume. The plankton of the South Pacific contained a greater number of species than were found in the North Pacific, but the volume of the tow reached its maximum in the northernmost part of the ocean. In the South Pacific the stations yielding the most species were located in the eastern part alongside the Humboldt Current and in the western part north of the Samoan Islands. In the North Pacific the richest stations were found off the coast of Japan in the western part, and halfway between San Francisco and the Hawaiian Islands in the eastern part. Station 56, situated in latitude 31° 49' south and longitude 109° 04' west, yielded 108 species and becomes thereby the banner station of the entire cruise. Station 35, outside the Pacific end of the Panama Canal, was second with 96 species, and station 113, close to the eastern coast of Japan, was third with 93 species. Stations 40 and 109 were fourth, each with 90 species. The last of these, number 109, was the station above the newly discovered Fleming Deep, the depth of the bottom being 5252 meters. There were 9 stations each yielding from 80 to 88 species, 18 stations each with 71 to 78 species, 16 stations each with 60 to 69 species, and 26 stations each with 50 to 59 species. This makes a total of 73 stations, or 59 per cent

of those in the Pacific, each listing 50 species or more.

In the Atlantic, the Caribbean Sea stations yielded a larger number of species than those in the Sargasso Sea. But, as already stated, both these regions were found by Jespersen (1926) to be much inferior to other parts of the North Atlantic.

DIVERSITY OF DISTRIBUTION

We have just seen that there is great disparity in the quantity of macroplankton obtained from different localities of the various oceans. In dealing with the copepods we may go farther and say that there is not a single species that does not show more or less diversity in its distribution. In more than 90 per cent of the species the diversity is so great that it becomes the predominant feature of the distribution. This diversity is evident not only in the horizontal or geographic distribution, but even more in the vertical distribution, as will be shown later. Any attempt, therefore, to calculate the number of copepods per liter or per cubic meter of the ocean water gives us no practical information. One might as well try to calculate the number of gulls and terns per cubic meter of the atmosphere above the ocean.

The recurrence of specific names in successive station lists might suggest at first thought a more or less uniform distribution. But when we consider the relative abundance, we are likely to find that the species was represented at one station by hundreds of individuals, whereas perhaps at the very next station the entire tow had to be carefully examined in order to secure a single specimen.

The concept of diversity is greatly strengthened by a study of the data contained in the station lists here recorded, especially those on relative abundance. Simply the name of the species has heretofore been recorded, and usually we have been left in complete ignorance of its comparative abundance and its vertical distribution. The interesting and valuable information which may be derived from such data furnishes an abundant warrant for their publication. Of the 263 different species recorded from 166 localities in the Pacific Ocean, 105 appear at 5 localities or less, 60 being each confined to a single locality. Of the remainder, 120 species are restricted to a total of 50 localities or less, which is only a two-sevenths distribution. Only 7 species, or less than 3 per cent of the entire number, have any claim to universal distribution, and each of them shows great diversity in its relative abundance.

A remarkable instance of inequality in distribution is shown by two surface tows taken between stations 50 and 51. The tows were made consecutively at the same locality, on the same day, and with the same net. Together they yielded 42 species, and 23 of these, or more

than half, were found in one tow only and did not appear at all in the other. Two surface tows between stations 62 and 63, taken on the same day, with the same net, but a short distance apart, yielded 50 species, 32 of which, or 64 per cent, were confined to one of the tows. Between stations 63 and 64 three surface tows were made on January 2 and three others on January 3, all with the same net, but short distances apart. The first three tows yielded 44 species, of which 26 appeared in one tow only. The second three tows gave a total of 37 species, and 22 of these were found in one tow only.

Such data not only confirm the irregularity of distribution in the plankton, but also suggest that, even in restricted areas, what may be termed the "personnel" of the plankton is constantly changing. Two tows over the same area, no matter how quickly one may follow the other, will never yield identical results. Having thus established the lack of uniformity in the horizontal or geographical distribution of the copepods, we turn to their vertical distribution.

DAYTIME STRATIFICATION

The different species of copepods that are found near the surface of the ocean in the daytime show a marked tendency to arrange themselves in zones or layers parallel with the surface. Some species are practically confined to the surface tows, of which they often constitute a very large percentage, rarely as high as 90 to 95 per cent. Others are confined entirely or very largely to the 50-meter tow, and still others apparently do not approach nearer to the surface than the 100-meter tow.

If the station lists are compared, it will be found that this stratification is apparent in every one of them. Percentages large enough to constitute definite evidence of layering are always present. This does not necessarily mean that any one species is always and everywhere found at one of the three depths and never at either of the other two, although even that is true in some instances. But it does signify that at the time the tow was taken and under the existing conditions, very respectable percentages of the copepods showed a decided preference for one of the three depths to the exclusion of the other two. On an average, about half the copepods present at each station show such an exclusive preference, and most of the other half show a similar but less marked liking for some one of the zones. They are found in abundance in the preferred zone, but only rarely or in small numbers in the other two zones, being often wholly absent from one of them. In all probability a closing net would eliminate many of these secondary appearances and credit more species with exclusive preference for the zones where they were most abundant. Two or three

examples will illustrate the evidences of such stratification more clearly.

The list for station 35 shows 10 species confined to the surface tow, 13 to the 50-meter tow, and 24 to the 100-meter tow. Forty-seven species, therefore, out of a total of 96 showed definite selection of a single depth to the exclusion of the other two. Thirty other species were found in two of the tows but not in the third one, thus manifesting a similar but less exclusive selection. Furthermore, in only 2 instances do we find the abundance records of any species in the two tows exactly the same. In 7 other instances, however, both records are expressed in numerals, with not enough difference between them to warrant any assumption of real preference. Eliminating these 9 records, the other 16 species do manifest a more or less decided preference for one of the two depths over the other. Finally, there were 19 species which were found at all three depths. In 5 instances the abundance record was exactly the same at the three depths. For 9 other species it was the same at two depths and differed in the third. In the remaining 5 species the records show a decided preference for one depth over the other two. Of the 96 species taken at this station, therefore, 68 (71 per cent) showed good evidence of selection in the depth at which they were found.

In the list for station 56, 49 species were restricted to a single depth, 44 were taken at two depths but not at the third, and 15 were present at all three depths. Of the 44 two-depth species, 19 showed a definite preference for one depth over the other, and of the 15 three-depth species, 11 distinctly favored one of the depths in preference to the other two. Here, then, 79 species (73 per cent) manifested a choice of depth.

At station 51, 39 of 50 species were confined to a single depth; 10 others were present at two depths, with 6 of them preferring one of the depths to the other. A single species was found at all three depths, with the same record for two of them and a much smaller one for the third. Here, then, 45 species (90 per cent) showed selective stratification.

Every one of the lists gives evidence of similar stratification of the copepods captured at the station. The number of species manifesting an exclusive preference for one depth only and those that were present at all three depths are recorded in the remarks accompanying each station list. The former constitute from 50 to 90 per cent of the species total in three-fourths of the station lists, and in the other fourth they fall below 40 per cent only twice. The species present at all depths vary from 0 to 30 per cent of the species total, with an average of about 15 per cent. Among these species the number of instances in which the abundance record is the same for all three depths is so small as to be practically negligible. Sum-

ming up the evidence here presented, we find that almost every species in each of the station lists shows some degree of preference as to depth.

CAUSES OF DAYTIME STRATIFICATION

We naturally look for the cause of this universal daytime stratification within the upper 100 meters of the ocean. Is it the salinity, the temperature, the density, the hydrogen-ion concentration, any combination of two or more of these factors, or the united effect of all of them? Or may it be something outside, more powerful than any of them, or even than all of them combined? Since we have the necessary data in connection with the station lists, some answer to these questions ought to be possible. Let us consider the data separately, beginning with temperature.

Temperature

There is no doubt that temperature does exert considerable influence on copepod distribution. Is it strong enough to produce such a universal stratification? And if so, is there sufficient difference in temperature between the three depths at which the tows were taken to warrant its selection as the principal cause? At first it would seem as if the answer might be in the affirmative.

The greatest variations in temperature of the ocean water are nearest the surface. The upper 100 meters, within which all but one of the *Carnegie* tows were taken, show the maximum differences between the various regions of an ocean—polar, temperate, and tropical. Here also are found the maximum differences in temperature between the vertical depths 0, 50, and 100 meters. Below 100 meters there is a gradual approach to uniformity of temperature over the entire area of all the oceans.

Variations in temperature are undoubtedly one of the causes of the marked differences in the copepod species that make up the regional plankton of the upper 100 meters. The *Carnegie* stations in the Pacific ranged from 52° north latitude through the tropics to 40° south latitude. The low temperatures of the upper 100 meters north of parallel 40° north entirely exclude many of the copepods that are common in the tropics. The number of species taken at each of the 12 stations in that part of the Pacific was thus reduced to an average of only 16. A comparison of this average of 16 with the average of 83 for stations 35 to 44 in the tropics suggests the powerful influence of temperature on regional distribution. Is its influence on vertical distribution equally great? These few species at the northern stations showed the same evidence of stratification as the more numerous species in the tropics. That this stratification is not due to the ver-

tical differences in temperature, however, is apparent on examination of the station lists. At station 121, for example, the three tows yielded 18 species of copepods. Two species only were found at the surface, one of which was represented by development stages only, with no adults. Eleven species were present in the 50-meter tow, and 16 in the 100-meter tow. Two of the former and 6 of the latter were not present in either of the other two tows. The temperature at the surface was only $7^{\circ}.4$ C; at 50 meters it dropped 4° , and at 100 meters $1^{\circ}.5$ more. If the variation in temperature were the reason for the copepods' choice of depth, the 16 species should have been found at the surface and not at the 100-meter level. Moreover, a difference of only $1^{\circ}.5$ would hardly be sufficient to cause a third of the entire number of species to locate at the 100-meter level to the exclusion of the 50-meter level.

At station 127, 14 species were obtained; 6 species were present in the surface tow, 6 in the 50-meter tow, and 10 in the 100-meter tow. Three species were confined to the surface, 1 to the 50-meter level, and 5 to the 100-meter level. The temperature at the surface was $13^{\circ}.3$ C; it dropped 3° at 50 meters and 2° more at 100 meters. The same considerations as before preclude the assumption that the variation in temperature was the cause of the differences in depth of the copepod species. Any copepod that has become inured to living and breeding in water as cold as is found in these northern latitudes will not be much affected by changes of 2° or 3° in temperature.

In the tropics, on the other hand, the water at the surface is much warmer and the differences in temperature between the three tow depths are sometimes large enough to appear like important factors in copepod zoning. At station 35, for instance, the temperature at the 100-meter level was 13° lower than at the surface. At station 39, on the equator, it was nearly 11° lower; at stations 71 and 72, latitude 10° south, it was about 10° lower. At station 109, over the Fleming Deep, there was a drop of 8° , at several of the stations north of the Hawaiian Islands the drop was 7° to 9° , and at a few stations southeast of the Hawaiian Islands there was a difference of 8° to 16° . These variations are all of sufficient magnitude to suggest an appreciable influence of temperature on stratification. An examination of the species lists at these stations reveals exceptionally well marked stratification, but in every instance it is the exact opposite of what it should be, on the hypothesis that higher temperature induces greater concentration of copepods. The species were bunched at the two lower levels instead of at the two upper ones, and the 100-meter tow contained sometimes two or even three times as many species as were found at the surface. At station 152, the water at 50 meters was 13° colder than at the surface, and at the 100-meter level

it fell 3° more, a total drop of 60 per cent. Yet the 100-meter tow contained almost three times as many species as the surface tow, and the 50-meter tow nearly twice as many.

Frequently, however, the tropical stations showed but little temperature change at the three tow depths. At station 46, for example, the difference in temperature between the surface and the 100-meter depth was less than 1° . Yet 4 species were restricted to the surface tow, 5 to the 50-meter tow, and 13 to the 100-meter tow. At stations 91 and 93 the difference in temperature between the two tow depths (0 and 50 meters) was $0^{\circ}.2$, but 80 per cent of the copepod species were present in one tow and absent from the other. At station 80 the difference in temperature between the two depths was only $0^{\circ}.1$, but 11 species were confined to the surface tow and 23 to the 50-meter tow. A difference of $0^{\circ}.1$ in temperature would hardly constitute a sufficient incentive for the exclusive stratification of 63 per cent of the 54 species captured at this station. At station 81 exclusive stratification was shown by 70 per cent of the 47 species, with only $0^{\circ}.1$ difference in the temperature of the two tows. At station 82 there was absolutely no difference in temperature at the two tow depths, and still 70 per cent of the 52 species showed a definite choice of one of the depths to the exclusion of the other. At station 160 the temperature was exactly the same at all three depths, but 50 per cent of the species were confined to a single level, and 25 per cent more were present in two of the tows but absent from the third. Three-fourths of the species thus showed definite zoning without any temperature incentive. We are forced to conclude, therefore, that in most cases the temperature variation is not large enough to produce the amount of stratification shown; and when it does appear to be of sufficient size, it seems to have the opposite effect from what would be expected.

In this connection it must be noted that some copepod species are not influenced by even considerable changes in temperature, and that many of them appear immune to low temperatures. Expeditions into both the Arctic and Antarctic regions have revealed species of copepods, accustomed to warmer regions, living in the icy waters of those regions, and apparently breeding freely. The same is true of the copepods that live at considerable depths in the temperate and tropical regions. A tow was taken July 20, 1933 in a closed net south of Georges Bank about 39° north latitude at a depth of 2000 meters. The net worked perfectly, going down closed, opening at the desired depth, and closing again before being drawn up. An examination of this tow revealed hundreds of *Metridia* belonging to four different species, and also specimens of *Rhincalanus*, *Eucalanus*, *Pareuchaeta*, *Centropages*, *Heterorhabdus*, *Lucicutia*, *Haloptilus*, *Gaidius*, *Pseudochi-*

rella, *Pleuromamma*, and other genera. The temperature at 2000 meters was below 3° C, and yet these copepods seemed as healthy and active as other specimens of the same species captured within the upper 100 meters, where the temperature ranged from 15° to 21° C. It is evident that even considerable variations in temperature would affect such copepods very little, if at all.

Salinity (Map 3) and Density

In contrast with the temperature, both the salinity and the density differ so little within the upper 100 meters that they probably exert no influence on the vertical distribution of the copepods. But they do appear to affect the regional distribution to a certain extent. The surface salinity is a little higher in the Atlantic than in the Pacific Ocean, which may be a contributing factor in the superior quantity and variety of the Pacific plankton. None of the *Carnegie* stations came within the area of maximum surface salinity in the North Atlantic, but those numbered from 22 to 34 were in the zone of minimum salinity, and it is worthy of note that they yielded a larger average number of species than any of the others. Again, the area of maximum salinity in the Pacific Ocean lies around the Society Islands. The *Carnegie* passed through this area, and the station lists from within it are below the average. All the stations where the largest numbers of species were obtained show salinities at or a little below the average. This would seem to indicate that such average salinities are most acceptable to copepods and that there is a tendency to avoid both extremes. The salinities and densities at the three tow depths are exactly the same in many of the station lists. When they do differ, it is within such narrow limits as to preclude any appreciable influence on vertical distribution.

Hydrogen-Ion Concentration

The same statement may be made about the hydrogen-ion content of the sea water as about the salinity and density. The hydrogen-ion concentration is too often exactly the same for all three tow depths, and when it does vary the extent of the variation is too slight to warrant an assumption that it has any material influence on the vertical stratification of the copepods.

Phototropism

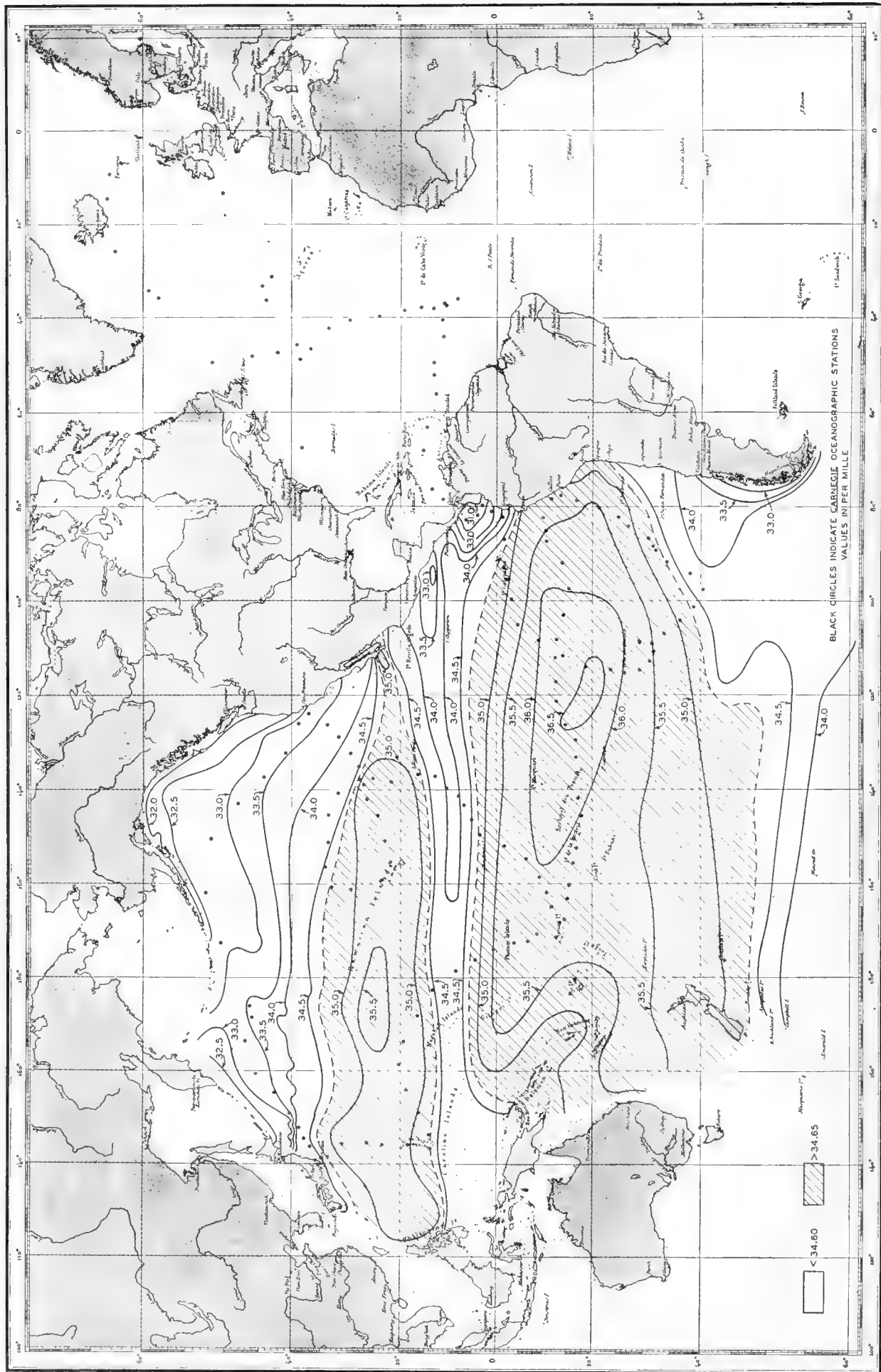
The preceding discussion has shown that neither temperature nor salinity, hydrogen-ion concentration, or density could produce the daytime stratification of which we find definite evidence in every station list of species. Temperature and salinity are concerned in the regional distribution of the species and may answer the question as to why a given copepod is found at one station or in one locality and not in another; neither density nor

hydrogen-ion concentration appears to enter appreciably into even this kind of distribution. We are forced to look elsewhere for the cause of the daytime stratification. We must search for something that is everywhere present in the daytime, that is at work all the time from dawn to dusk, and that is strong enough to produce definite and uniform results even in the face of antagonistic influences. The very fact that this is a daytime stratification suggests sunlight as its cause, and after the elimination of everything else, this is the only cause left that answers all the requirements that have just been enumerated.

It has been found by many observers that light is the most important factor controlling the nocturnal migration of copepods, and it is perfectly logical that it should also control their diurnal movements. Many species of copepods in both salt and fresh water migrate regularly from greater or lesser depths toward the surface as soon as it begins to be dark, and begin to return between midnight and sunrise. It is evident that the depth from which a copepod will be able to reach the surface is necessarily limited by its swimming ability. The jerky movements characteristic of copepod locomotion are not conducive to even moderate rapidity, and they are never continued steadily for any length of time. The progress is always leisurely, interspersed with frequent rests and periods of floating. The only occasion when a copepod tries to move rapidly is in an attempt to escape impending danger, and even then its efforts are spasmodic and nearly always futile. Moreover, its course is never in a straight line for any considerable distance, but is full of turns and twists and often spiral movements.

Another fact must also be considered, namely, that the interval between sunset and sunrise varies greatly with the season of the year and with the latitude of the location. All the *Carnegie* stations were located in the tropical and temperate zones. The observations in the North Atlantic were made from the middle of May to the first of October, those in the South Pacific from the first of November to the last of April (southern summer), and those in the North Pacific from the first of May to the middle of October. At practically every one of the stations, therefore, the time of year and the latitude were such as to give considerably reduced periods of darkness, with a corresponding increase in the periods of daylight.

Such considerations lead inevitably to the conclusion that the diurnal migrations are confined to the upper layers of the ocean water and do not reach any considerable depth. It would seem as if from 100 to 150 meters were about the lowest depth from which the average copepod would be able to reach the surface. But of course the migration is not limited by the copepod's ability actually to reach the surface within a given period. It undoubtedly takes place down to the limit of



MAP 3. Salinities in the Pacific Ocean

light penetration. Although the copepods taking part in this deeper movement would not reach the surface, they might be found at the 50-meter or 100-meter level during the night.

If it be true that the coming of daylight furnishes the incentive for the departure of the copepods from the surface, it follows that the depth to which they retire below the surface will vary with the intensity of the light. They will descend farther on a bright, sunny morning than when it is cloudy and lowering. On a day that is ushered in with clouds so dark and gloomy that the sunshine can scarcely penetrate them at all, the copepods may well stay near the surface long after sunrise and descend but a short distance. The varying intensity of the light offers a good explanation of the fact that some species are found close to the surface at one station and considerably removed from it at another, perhaps the very next one. Damas and Koefoed (1907) summed up their work on the plankton of the Greenland Sea as follows: "At any given place the organisms are distributed according to the degree of light for which they are sensitive. They rise and fall according to the daily variations in light intensity. The level at which a form remains is different from sea to sea. Species which live at the surface in the polar sea are found in the depths under the equator. Others that are seen to exist in the intermediate layers in the north are only found in the abyss at the south." Russell (1927*b*) confirmed these statements and added that copepods also show seasonal variation in their vertical distribution, going deepest in mid-June when the light intensity is greatest.

Again, we cannot expect the same intensity of light to affect different species equally, and here we have a reason for the fact which is so evident in every one of the station lists. Some species remain at the surface no matter how intense the light becomes; the others migrate downward but stop at different levels according to the amount of influence exerted on them by the light. We are thus enabled to understand how it is that the copepods become so distinctly stratified at every one of the stations in the daytime and also why we find the same species concentrated in different strata on different days. Russell went farther and declared: "In the sea each plankton animal may have its own vertical zone in which it finds certain conditions most favorable. This zone varies for different species, for individuals of the same species at different ages and stages of development, and even for the different sexes."

Although, therefore, this is not the first time that stratification of the plankton under the influence of sunlight has been proposed, it is here proved to exist among the copepods over a much more extensive area of two oceans than had hitherto been studied. The fact that every one

of the station lists without exception gives definite evidence of this stratification would seem to warrant the general statement that it exists everywhere in the open ocean during the daytime.

Michael (1913) discovered a similar stratification among the chaetognaths of the San Diego region, California. He concluded that each species had its own definite and specific manner of vertical distribution just as truly as it had its own specific morphological characteristics, and that the two were more or less interrelated. Rose (1925) made an extensive study of the biology of the plankton at Roscoff on the coast of France. He included the entire plankton in his study and, among the other forms, six of the copepods most abundant at that locality. Later he repeated his Roscoff experiments with other copepods at Banyuls-sur-Mer on the Mediterranean. From these experiments he concluded that below a certain inferior light-intensity limit the copepods were positively phototropic, above a certain superior light-intensity limit they were negatively phototropic, and between the two limits they were indifferent. He concluded that the daily vertical migration is due to the following influences: (1) Sunlight provokes the movement, directs it, and partly regulates it. (2) Temperature modifies more or less the action of the light energy, and when high enough may even reverse the action of phototropism. These interactions between temperature and phototropism have been verified by other observers: Parker (1902) found that the females of *Labidocera aestiva* had a strong positive phototropism for light of low intensity, whereas the males had a weak negative phototropism; these were unaltered in both sexes by temperature changes between 10° and 35° C; in a strong light the female became negative, but the male was not affected. Russell (1928) found that *Calanus finmarchicus* was negative to light at medium temperatures but became positive at 13° C and strongly so below 10° C; *Metridia lucens* was negative at ordinary temperatures but became positive at 10° C; *Acartia clausii* was strongly positive at ordinary temperatures but the phototropism entirely disappeared at 28° C; *Centropages hamatus* was positive up to 25° C, then became more and more indifferent to light and was finally negative. (3) Salinity, chemical composition, dissolved gases, etc. are accessory factors but usually have little if any influence. In exceptional conditions they may become of great importance. These experiments were made near the shore in comparatively shallow water, where physicochemical conditions would have a somewhat increased influence. In the open ocean the influence of the temperature and accessory factors would be considerably reduced and that of the sunlight correspondingly increased. Rose (1925) suggested that the majority of the animals in the plankton are adapted to an optimum intensity of light, and

that this varies with each species and possibly with each individual, and is affected by the physicochemical factors of its environment. The optimum zone of distribution changes with the age of the animal and with its physicochemical state at any moment. This explains the fact that nearly all the copepods show a strong positive phototropism during their development stages, although many of them become negatively phototropic on reaching maturity. Russell (1927*b*) confirmed this and added: "The gradual changes in vertical distribution throughout the life of an individual have been termed ontogenetic migrations."

Russell (1925, 1926*a*, 1926*b*, 1926*c*, 1927*a*, 1928) has published several papers on "The vertical distribution of marine macroplankton." He deals with the entire plankton, especially the young of fishes, and devotes one paper to light intensity as a controlling factor in plankton distribution (1926*c*, p. 415). He gives the vertical distribution of *Calanus*, *Centropages*, and *Temora* in water over 50 meters deep, at different hours of the day, under different intensities of light, and during different months of the year. We gather from these that the vertical distribution sometimes begins below the surface, attains its maximum at depths of 5 to 20 meters, and then diminishes and disappears before reaching a depth of 50 meters. This distribution was in water which was shallow as compared

with the open ocean, but there is no reason why it should not occur also in the open ocean at least to some extent. If it does, then we should find communities in the 25-meter zone differing more or less from those at the surface and at the 50-meter level. In all probability, therefore, a tow taken at the 25-meter level would contain species not found at the surface or at the 50-meter level. Similarly, the 75-meter level would probably be found to contain species different from those of the 50-meter and 100-meter levels. We are thus forced to the inference that the *Carnegie* tows probably did not obtain all the species that occur within the upper 100 meters of the ocean water.

Incidentally, also, these considerations indicate the inadequacy of results obtained by daytime tows at the surface alone in an effort to determine the plankton of any given locality. The number of species thus obtained would constitute so small a fraction of the entire plankton at the locality that it would have but little value. A surface towing in the night, on the contrary, might give a very respectable indication of the total plankton, since many of the species that remain at deeper levels during the daytime come to the surface at night. To obtain satisfactory results, therefore, there must be tows at different levels during the daytime and these must be supplemented by tows at or near the surface at night.

LISTS OF SPECIES BY STATIONS

As already stated, the station lists which follow contain all the available data for each station in reference to temperature, salinity, density, and hydrogen-ion concentration. In addition, every species is recorded from the depth or depths at which it was obtained, and its relative abundance is given.

For 5 specimens or less, the actual number is given. Above that number, the letter *r* (rare) indicates 6 to 10 individuals; *f* (few), 11 to 24; *c* (common), 25 to 50; and *a* (abundant), over 50. Actual count was made up to 25; above that, the numbers were estimated. This method of record gives us not merely the regional distribution, but also the vertical distribution at each station, and reveals very clearly the stratification or layering of the copepod species during the daytime. Attention is

again called to the fact that the three tows at all the regular stations were made at about the same time of day, which adds greatly to their value for purposes of comparison.

In the remarks under each of the station lists are noted the important data for that station. The total number of species found at each depth is also given, together with the number and percentage of species which were confined to a single depth as well as the number found at all three depths. Comparisons are also made between the tows taken at the regular stations in the daytime and the surface tows made between stations, usually during the night. In many instances these comparisons reveal nocturnal migrations to the surface on the part of some of the species.

STATION 1

May 12, 1928; 38° 14' N, 67° 34' W; bottom depth, 4900 m; 49 species

Depth of tow, m	0	70	Depth of tow, m	0	70
Temperature, °C	24.0	22.5	Density (σ_t)	24.5	25.5
Salinity, ‰	36.2	36.4	Hydrogen-ion concentration (pH)	8.16	8.17

<i>Calanus minor</i>	c	c	<i>Mecynocera clausi</i>	r	..
<i>propinquus</i>.....	..	f	<i>Megacalanus longicornis</i>.....	..	f
<i>Calocalanus pavo</i>	f	f	<i>Microsetella norvegica</i>	c	r
<i>Candacia norvegica</i>	r	f	<i>rosea</i>.....	..	r
<i>Centropages furcatus</i>.....	..	r	<i>Miracia efferata</i>	2	3
<i>Clausocalanus arcuicornis</i>	c	c	<i>Oithona plumifera</i>	f	c
<i>Clytemnestra scutellata</i>.....	..	f	<i>similis</i>.....	..	1
<i>Copilia denticulata</i>	i	f	<i>spinirostris</i>	3	r
<i>Corycaeus anglicus</i>	r	f	<i>Oncaea minuta</i>.....	..	r
<i>crassiusculus</i>	f	c	<i>venusta</i>.....	..	c
<i>flaccus</i>	f	f	<i>Paracalanus parvus</i>	f	1
<i>lautus</i>	r	f	<i>Phaenna spinifera</i>	c	3
<i>minimus</i>	r	..	<i>Pontella pennata</i>	1 ♀	..
<i>ovalis</i>	r	..	<i>Pontellina plumata</i>.....	..	2
<i>speciosus</i>	a	c	<i>Pseudocalanus minutus</i>.....	..	c
<i>typicus</i>	f	c	<i>Rhincalanus cornutus</i>.....	..	r
<i>Euchaeta marina</i>	c	c	<i>nasutus</i>.....	..	r
<i>Euchaetopsis</i> ?, juv.....	2	..	<i>Sapphirina angusta</i>.....	..	r
<i>Euchirella curticauda</i>	f	..	<i>auronitens</i>	f	1
<i>pulchra</i>	c	..	<i>nigromaculata</i>	f	f
<i>Farranula carinata</i>	c	c	<i>Scolecithrix danae</i>.....	..	f
<i>gibbula</i>	r	f	<i>Temora longicornis</i>	f	c
<i>gracilis</i>.....	..	f	<i>stylifera</i>	a	c
<i>rostrata</i>	f	r	<i>Undinula vulgaris</i>.....	..	f
<i>Macrosetella gracilis</i>	f	c			

This station was just at the eastern edge of the Gulf Stream and showed a fairly high surface temperature, which fell only 1.5 in the upper 70 meters. The salinity, density, and hydrogen-ion concentration were practically the same at both depths, the differences being too small to affect distribution. Twenty-two of the species (46 per cent) were confined to a single depth, and 15 of the species found in both tows showed

an appreciable difference in relative abundance. The two genera *Corycaeus* and *Farranula* yielded the greatest number of species and constituted a large bulk of the tows in spite of their diminutive size. This is the only Atlantic record for *Corycaeus ovalis* and *Euchirella curticauda* and is one of two Atlantic records for *Euchirella pulchra*; and *Pontella pennata*, a single female, is the only record of this species for the cruise.

BETWEEN STATIONS 1 AND 2
 May 16, 1928; 37° 45' N, 53° 26' W; 49 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
<i>Acartia clausii</i>	r	..	..	<i>Mecynocera clausi</i>.....	..	c	f
<i>Calanus minor</i>	f	a	a	<i>Megacalanus princeps</i>	f	f	..
<i>Calocalanus pavo</i>	r	r	f	<i>Microsetella norvegica</i>	r	r	r
<i>Canadacia aethiopica</i>	r	..	..	<i>Miracia efferata</i>.....	..	r	..
<i>bispinosa</i>	f	r	r	<i>Oithona plumifera</i>	a	f	f
<i>Centropages furcatus</i>.....	..	r	r	<i>similis</i>	c	f	r
<i>Clausocalanus arcuicornis</i>	r	..	f	<i>spinirostris</i>	r	..	..
<i>Clytemnestra scutellata</i>.....	..	..	r	<i>Oncaea curta</i>	f	f	..
<i>Copilia denticulata</i>.....	..	r	r	<i>media</i>	c	..	..
<i>Corycaeus anglicus</i>.....	..	f	..	<i>minuta</i>.....	..	..	f
<i>crassiusculus</i>	c	c	f	<i>similis</i>	r	..	..
<i>flaccus</i>	f	f	f	<i>venusta</i>	c	a	c
<i>limbatus</i>	r	..	..	<i>Pachos punctatum</i>.....	..	..	2
<i>speciosus</i>	a	f	c	<i>Paracalanus parvus</i>	c	r	r
<i>typicus</i>	f	f	f	<i>Phaenna spinifera</i>.....	..	a	c
<i>Eucalanus attenuatus</i>	r	..	..	<i>Rhincalanus cornutus</i>	r	..	..
<i>elongatus</i>	f	r	r	<i>nasutus</i>	f	f	a
<i>Euchaeta marina</i>	r	f	r	<i>Sapphirina darwinii</i>.....	..	r	..
<i>Farranula carinata</i>	c	f	c	<i>nigromaculata</i>	r	..	..
<i>curta</i>.....	..	r	..	<i>Scolecithricella minor</i>.....	..	5	..
<i>gibbula</i>.....	..	r	..	<i>Scolecithrix danae</i>.....	..	c	r
<i>rostrata</i>	c	f	f	<i>Temora longicornis</i>.....	..	..	r
<i>Lucicutia clausii</i>.....	..	..	r	<i>stylifera</i>	c	f	a
<i>flavicornis</i>.....	..	..	f	<i>Undinula vulgaris</i>.....	..	c	f
<i>Macrosetella gracilis</i>	f	r	r				

This was the only occasion during the entire cruise when tows at all three depths were taken between stations. The vertical distribution of the species was 31 at the surface, 33 at 50 meters, and 32 at 100 meters, an exceptionally uniform dispersion. Twenty-one species (43 per cent) were confined to a single depth, and 19 were found at all three depths. This is

the only cruise record for *Sapphirina darwinii*, and the only Atlantic record for *Eucalanus attenuatus*, *Megacalanus princeps*, and *Pachos punctatum*. The presence of these isolated species and the unusual uniformity in vertical distribution is accounted for by the fact that these tows were taken during the night and not in the daytime.

STATION 2

May 18, 1928; 39° 06' N, 45° 41' W; bottom depth, 3900 m; 37 species

<i>Acartia longiremis</i>	4	<i>Farranula curta</i>	f	<i>Oncaea venusta</i>	c
<i>Calanus minor</i>	c	<i>gibbula</i>	c	<i>Paracalanus parvus</i>	c
<i>Calocalanus pavo</i>	f	<i>rostrata</i>	c	<i>Phaenna spinifera</i>	r
<i>Centropages chierchiae</i>	3	<i>Macrosetella gracilis</i>	c	<i>Pontellina plumata</i>	r
<i>Copilia denticulata</i>	r	<i>Mecynocera clausi</i>	f	<i>Rhincalanus cornutus</i>	r
<i>Corycaeus agilis</i>	r	<i>Microsetella norvegica</i>	f	<i>nasutus</i>	a
<i>crassiusculus</i>	a	<i>Miracia efferata</i>	r	<i>Sapphirina angusta</i>	2
<i>flaccus</i>	f	<i>Oithona plumifera</i>	f	<i>auronitens</i>	r
<i>speciosus</i>	a	<i>similis</i>	f	<i>nigromaculata</i>	f
<i>typicus</i>	f	<i>Oncaea media</i>	c	<i>Temora longicornis</i>	r
<i>Eucalanus elongatus</i>	f	<i>minuta</i>	c	<i>stylifera</i>	c
<i>Euchaeta marina</i>	r	<i>similis</i>	f	<i>Undinula vulgaris</i>	r
<i>Farranula carinata</i>	a				

At this station only a surface tow was taken, with the temperature 20.5, the salinity 36.4 o/oo, and the hydrogen-ion concentration 8.23. The time was late in the forenoon and the sea was too rough to attempt the deeper tows. It must have

been also very dark and lowering, since the 2 *Rhincalanus* species were still at the surface, whereas they were usually confined to the deeper tows. This was the only record for *Centropages chierchiae* during the entire cruise.

STATION 3

May 21, 1928; 44° 00' N, 36° 10' W; bottom depth, 3738 m; 21 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	15.5	14.9	13.6	Density (σ_t)	26.6	26.9	27.4
Salinity, o/oo	36.0	35.9	35.8	Hydrogen-ion conc. (pH)	8.15	8.14	8.10
<i>Acartia longiremis</i>.....	..	f	..	<i>Oithona plumifera</i>	c	..	f
<i>Calanus helgolandicus</i>.....	..	..	f	<i>setiger</i>.....	..	r	..
<i>minor</i>	f	f	..	<i>similis</i>	f	r	f
<i>Candacia bispinosa</i>	r	..	..	<i>Oncaea minuta</i>	c	..	..
<i>Centropages furcatus</i>	r	..	..	<i>venusta</i>	c	..	..
<i>Clausocalanus arcuicornis</i>.....	..	r	..	<i>Paracalanus parvus</i>	f	r	f
<i>Eucalanus elongatus</i>.....	..	f	..	<i>Rhincalanus nasutus</i>.....	..	r	..
<i>Farranula carinata</i>	r	..	..	<i>Sapphirina angusta</i>	r	..	..
<i>rostrata</i>	f	..	..	<i>nigromaculata</i>	r	..	..
<i>Labidocera nerii</i>.....	..	r	..	<i>Scolecithrix danae</i>.....	..	c	f
<i>Mecynocera clausi</i>	f	f	f				

Fifteen of the species (71 per cent) were confined to a single tow; there were 13 species at the surface, 11 at 50 meters, and 6 at 100 meters, the last being an exceptionally small number.

Only 4 species were common, 1 *Oithona* and 2 *Oncaea* at the surface, and *Scolecithrix* at 50 meters. Development stages were abundant at each depth but could not be identified.

STATION 4

May 23, 1928; 44° 39' N, 33° 06' W; bottom depth, 2439 m; 14 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	14.6	14.3	13.4	Density (σ_t)	26.7	27.1	27.4
Salinity, o/oo	35.9	36.0	35.8	Hydrogen-ion conc. (pH)	8.16	8.15	8.12
<i>Calanus helgolandicus</i>.....	..	f	a	<i>Oithona similis</i>	c	f	c
<i>minor</i>	a	..	..	<i>Paracalanus parvus</i>	f	..	..
<i>Calocalanus pavo</i>.....	..	r	..	<i>Pseudocalanus minutus</i>	r	r	..
<i>Clausocalanus arcuicornis</i>.....	..	..	r	<i>Sapphirina angusta</i>	r	..	..
<i>Drepanopus pectinatus</i>.....	..	..	r	<i>nigromaculata</i>	f	r	r
<i>Mecynocera clausi</i>.....	..	c	f	<i>stellata</i>	r	..	..
<i>Oithona plumifera</i>	c	f	c	<i>Scolecithrix danae</i>.....	..	f	c

Seven species, or just half the entire number, were confined to a single tow, and the vertical distribution was also unusually regular, with 8 species at each of the three depths.

This is the only record for *Drepanopus pectinatus*, which was confined to the 100-meter tow. The development stages were found only in the 50-meter tow and could not be identified.

STATION 5

May 25, 1928; 43° 15' N, 31° 32' W; bottom depth, > 2719 m; 21 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	15.0	14.6	13.5	Density (σ_{tP})	26.6	27.0	27.4
Salinity, o/oo	35.8	36.0	35.8	Hydrogen-ion conc. (pH)	8.19	8.21	8.15

<i>Acartia clausii</i>	f	r	..	<i>Oithona plumifera</i>	r	f	..
<i>longiremis</i>	r	..	..	<i>setiger</i>	f	..	..
<i>Calanus helgolandicus</i>	r	..	..	<i>similis</i>	a	a	a
<i>minor</i>	f	..	..	<i>Oncaea minuta</i>	f	..	..
<i>Calocalanus pavo</i>.....	..	..	r	<i>venusta</i>	r	..	..
<i>Centropages furcatus</i>	r	..	..	<i>Pseudocalanus minutus</i>.....	..	f	r
<i>Clausocalanus arcuicornis</i>	c	c	f	<i>Rhincalanus nasutus</i>	f	..	r
<i>Farranula carinata</i>.....	..	r	..	<i>Sapphirina angusta</i>.....	..	..	f
<i>gibbula</i>	f	..	..	<i>nigromaculata</i>.....	..	..	r
<i>Mecynocera clausi</i>	c	c	c	<i>stellata</i>	r	c	..
<i>Microsetella norvegica</i>	a	..	..		

The temperature varied only 1.5 in the upper 100 meters, and the salinity and hydrogen-ion concentration were nearly uniform. Fourteen species (66 per cent) were confined to a

single tow, with 17 at the surface, 8 at 50 meters, and 8 at 100 meters. Development stages were again abundant at all three depths.

STATION 6

May 31, 1928; 50° 22' N, 13° 31' W; bottom depth, 2604 m; 21 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	12.4	11.6	11.3	Density (σ_{tP})	26.9	27.3	27.6
Salinity, o/oo	35.5	35.5	35.5	Hydrogen-ion conc. (pH)	8.15	8.12	8.08

<i>Acartia clausii</i>	c	r	..	<i>Oithona setiger</i>	f	..	..
<i>Calanus helgolandicus</i>	c	..	..	<i>similis</i>	a	a	c
<i>Centropages furcatus</i>	r	r	r	<i>Oithonina nana</i>	f	..	..
<i>typicus</i>	r	..	..	<i>Oncaea minuta</i>	f	..	..
<i>Clausocalanus arcuicornis</i>	r	f	a	<i>venusta</i>.....	..	c	f
<i>Macrosetella gracilis</i>.....	..	..	r	<i>Paracalanus parvus</i>.....	..	c	r
<i>Mecynocera clausi</i>	r	..	..	<i>Pseudocalanus minutus</i>.....	..	..	f
<i>Metridia curticauda</i>	r	..	r	<i>Rhincalanus cornutus</i>.....	..	..	c
<i>Microsetella norvegica</i>	c	a	a	<i>nasutus</i>.....	..	..	f
<i>rosea</i>	r	..	..	<i>Sapphirina angusta</i>	r	..	..
<i>Oithona plumifera</i>.....	..	..	c				

The temperature dropped only 1° in the 100 meters, the salinity remained exactly the same, and the hydrogen-ion concentration diminished very slightly. There were 14 species in the surface tow, 7 in the 50-meter tow, and 12 in the 100-meter tow. Thirteen of the species (62 per cent) were confined to a single depth and only 4 were found at all three depths.

This is the only record of *Centropages typicus* for the entire cruise, a fact which, as this is a fairly common species, would seem to imply that it does not often come into the upper 100 meters. Here also is established one of the only two records for *Metridia curticauda*; the second record was made during the surface tow of July 11, between stations 6 and 7 (c).

BETWEEN STATIONS 6 AND 7 (a)
June 2, 1928; 49° 30' N, 12° 00' W; 22 species

Tow	1	2	3	Tow	1	2	3
<i>Acartia clausii</i>	a	f	a	<i>Oithona plumifera</i>.....	..	..	r
<i>Calanus helgolandicus</i>	r	r	..	<i>setiger</i>.....	..	..	r
<i>Candacia bispinosa</i>.....	..	..	r	<i>similis</i>	c	a	a
<i>Centropages furcatus</i>.....	..	r	..	<i>Oithonina nana</i>.....	..	f	r
<i>hamatus</i>	r	..	r	<i>Oncaea media</i>	r	..	..
<i>Clausocalanus arcuicornis</i>.....	..	..	r	<i>minuta</i>	f	..	..
<i>Farranula carinata</i>	1	..	..	<i>venusta</i>	r	r	f
<i>rostrata</i>	3	..	..	<i>Paracalanus parvus</i>	a	a	a
<i>Macrosetella gracilis</i>	r	..	r	<i>Pseudocalanus minutus</i>	f	c	c
<i>Metridia longa</i>.....	..	..	r	<i>Rhincalanus cornutus</i>.....	..	..	f
<i>Microsetella norvegica</i>	a	r	a	<i>nasutus</i>.....	..	..	f

These three tows were taken at the surface in the same locality successively at short intervals during the night of

June 2. A total of 22 species was obtained from all three tows, and 12 (55 per cent) of these were confined to a single tow.

BETWEEN STATIONS 6 AND 7 (b)
June 3, 1928; 50° 00' N, 12° 30' W; 15 species

Depth of tow, m	0	100	Depth of tow, m	0	100
<i>Acartia clausii</i>	a	a	<i>Oncaea media</i>	f	..
<i>Calanus helgolandicus</i>	r	r	<i>minuta</i>	c	f
<i>Metridia longa</i>	r	f	<i>venusta</i>	f	c
<i>Microsetella norvegica</i>	a	a	<i>Paracalanus parvus</i>	a	a
<i>Oithona plumifera</i>	f	..	<i>Pontella lobiancoi</i>	r	..
<i>setiger</i>	r	..	<i>Pseudocalanus minutus</i>	c	..
<i>similis</i>	a	c	<i>Sapphirina stellata</i>	r	..
<i>Oithonina nana</i>	r	f			

These two tows were taken in the night, and it is worthy of note that every one of the species found at the 100-meter level

was also present at the surface. There were 6 other species at the surface that were not found in the 100-meter tow.

BETWEEN STATIONS 6 AND 7 (c)

A. July 8, 1928; 54° 33' N, 6° 55' E

B. July 10, 1928; 58° 50' N, 1° 48' E

C. July 11, 1928; 59° 21' N, 1° 28' E

12 species

Location of tow	A	B	C	Location of tow	A	B	C
<i>Acartia clausii</i>	a	..	c	<i>Metridia curticauda</i>.....	..	..	r
<i>Calanus minor</i>	f	..	..	<i>Microsetella norvegica</i>.....	..	r	a
<i>Centropages hamatus</i>	a	..	f	<i>Oithona plumifera</i>.....	..	f	f
<i>Clausocalanus arcuicornis</i>	f	..	f	<i>Paracalanus parvus</i>	c	f	a
<i>Eucalanus elongatus</i>	f	..	..	<i>Pseudocalanus minutus</i>	f	f	f
<i>Labidocera wollastoni</i>	r	..	..	<i>Temora longicornis</i>	a	..	r

The interval between June 8 and July 7 was spent in the harbors of Plymouth, England, and Hamburg, Germany. Three surface tows were taken in the North Sea on three different nights as recorded above. Only 2 of the species were

taken in all three tows, but on the other hand only 4 species were confined to a single tow. The total of 12 species for three night tows is exceptionally small and indicates a restricted copepod plankton.

STATION 7

July 13, 1928; 63° 20' N, 9° 25' W; bottom depth, 454 m; 11 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	8.9	8.2	8.1	Density (σ_{tP})	27.3	27.7	27.9
Salinity, o/oo	35.2	35.2	35.2	Hydrogen-ion conc. (pH)	8.08	8.03	8.04
<i>Acartia clausii</i>	c	..	..	<i>Oithonina nana</i>	r	..	..
<i>Calanus finmarchicus</i>.....	..	a	a	<i>Oncaea venusta</i>	r	..	..
<i>helgolandicus</i>	a	a	c	<i>Paracalanus parvus</i>	c	f	r
<i>Microsetella norvegica</i>	f	r	r	<i>Pseudocalanus minutus</i>	c	f	c
<i>Oithona plumifera</i>.....	..	r	c	<i>Temora longicornis</i>	a	f	f
<i>similis</i>	c	c	f				

This station was just east of the southern coast of Iceland. The temperature at the surface was very low and fell less than a degree in the 100 meters; the salinity was exactly the same at all three depths, and the hydrogen-ion concentration varied extremely little. The bottom depth is next to the smallest for

the entire cruise. Only 3 of the species were confined to a single tow, and 6 were found in all three tows. This is the farthest north for *Oncaea* during the entire cruise, and this species may well have been brought into this vicinity by one of the ramifications of the Gulf Stream.

STATION 8

July 15, 1928; 63° 30' N, 14° 41' W; bottom depth, 1308 m; 12 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	10.3	9.0	8.4	Density (σ_{tP})	27.0	27.5	27.9
Salinity, o/oo	35.2	35.2	35.2	Hydrogen-ion conc. (pH)	7.93	7.95	7.95
<i>Acartia clausii</i>	r	..	..	<i>Oithona plumifera</i>	f	f	f
<i>Calanus finmarchicus</i>	f	..	c	<i>setiger</i>.....	..	..	f
<i>helgolandicus</i>	f	a	a	<i>similis</i>.....	..	a	a
<i>Clytemnestra rostrata</i>.....	..	r	..	<i>Oithonina nana</i>.....	..	f	r
<i>Gaidius brevispinus</i>.....	..	..	r	<i>Pontella lobiancoi</i>	r	..	..
<i>Microsetella norvegica</i>.....	..	a	a	<i>Pseudocalanus minutus</i>	r	c	..

This station was off the southern coast of Iceland but in very much deeper water than the preceding station. In the upper 100 meters the temperature varied 2°; the salinity and hydrogen-ion concentration were the same for all three depths.

In spite of the low temperature, many of the females in all three tows were carrying ovisacs with the eggs nearly ready to hatch. This was the only record for *Gaidius brevispinus*, and the only Atlantic record for *Clytemnestra rostrata*.

STATION 9

July 28, 1928; 62° 45' N, 25° 52' W; bottom depth, 882 m; 11 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	11.1	8.3	7.5	Density (σ_{tP})	26.8	27.5	27.9
Salinity, o/oo	35.1	35.1	35.1	Hydrogen-ion conc. (pH)	8.08	7.96	7.98
<i>Anomalocera patersonii</i>	c	..	..	<i>Oithona plumifera</i>.....	..	c	..
<i>Calanus finmarchicus</i>.....	..	..	a	<i>similis</i>	a	a	a
<i>helgolandicus</i>.....	..	f	..	<i>Oithonina nana</i>.....	..	..	f
<i>minor</i>.....	..	..	f	<i>Scolecithricella ovata</i>.....	..	..	r
<i>Euchirella rostrata</i>.....	..	..	1	<i>Scolecithrix danae</i>.....	..	r	..
<i>Microsetella norvegica</i>	a	a	r				

The temperature was still low at the surface, and fell 3° at 50 meters and another degree at 100 meters. Eleven species were obtained, of which 2 were found in all three tows and the other 9 (82 per cent) were confined to a single tow. This

is one of the two Atlantic records for *Anomalocera patersonii*; the other was established at station 10, immediately following. In the 100-meter tow is found the only record for *Scolecithricella ovata* for the entire cruise.

STATION 10

July 30, 1928; 59° 19' N, 34° 15' W; bottom depth, 3031 m; 8 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	10.9	10.0	6.6	Density (σ_{tP})	26.7	27.1	27.9
Salinity, ‰	34.9	34.9	35.0	Hydrogen-ion conc. (pH)	8.08	8.04	7.95
<i>Anomalocera patersonii</i>	2	..	..	<i>Oithona similis</i>.....	..	..	a
<i>Calanus finmarchicus</i>.....	..	..	a	<i>spinirostris</i>.....	..	..	f
<i>Euchaeta marina</i>.....	..	..	r	<i>Oithonina nana</i>.....	..	a	..
<i>Microsetella norvegica</i>.....	..	a	a	<i>Pseudocalanus minutus</i>.....	..	..	c

The 8 species here recorded constitute the smallest yield for any regular station at which all three tows were taken, and with only one exception they were all confined to a single depth. Although the temperature at the 100-meter level was

but 6°.6, that tow as well as the other two contained hundreds of nauplii and metanauplii, of which those in the 100-meter tow must have been negatively phototropic. This is the second of the two Atlantic records for *Anomalocera patersonii*.

STATION 11

August 1, 1928; 58° 12' N, 35° 51' W; bottom depth, 2633 m; 10 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	10.6	7.3	Density (σ_{tP})	26.7	27.6
Salinity, ‰	34.9	34.9	Hydrogen-ion concentration (pH)	8.06	7.92
<i>Calanus finmarchicus</i>.....	..	a	<i>Oithona similis</i>.....	..	a
<i>Euchirella rostrata</i>.....	..	r	<i>spinirostris</i>.....	..	r
<i>Heterorhabdus norvegicus</i>.....	..	f	<i>Oithonina nana</i>	a	..
<i>Metridia lucens</i>.....	..	r	<i>Pareuchaeta tonsa</i>.....	..	a
<i>Microsetella norvegica</i>	2	f	<i>Scolecithricella minor</i>.....	..	c

Eight of the 10 species were confined to the 50-meter tow, only 2 appearing at the surface. These tows were taken in a very dense fog, which may explain why some of the *Calanus finmarchicus* did not come to the surface. This is the only

record for *Heterorhabdus norvegicus* and the only Atlantic record for *Metridia lucens*, and the first of two for the *Carnegie* for this ocean for *Pareuchaeta tonsa*; the second was made at station 12, immediately following.

STATION 12

August 5, 1928; 51° 40' N, 49° 32' W; bottom depth, 2792 m; 10 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	8.4	3.9	3.4	Density (σ_{tP})	26.1	27.8	28.2
Salinity, o/oo	33.6	34.7	34.8	Hydrogen-ion conc. (pH)	8.10	7.96	7.91
<i>Calanus finmarchicus</i>	a	a	a	<i>Oithona spirostris</i>.....	..	f	a
<i>helgolandicus</i>	a	a	a	<i>Paracalanus parvus</i>.....	..	c	..
<i>Eucalanus elongatus</i>.....	..	r	..	<i>Pareuchaeta tonsa</i>.....	..	f	..
<i>Microsetella norvegica</i>.....	..	a	..	<i>Pseudocalanus minutus</i>.....	..	..	r
<i>Oithona similis</i>.....	..	c	a	<i>Scolecithricella minor</i>.....	..	c	r

The temperature here was low at the surface and dropped at the 50-meter level to 3°9, at the 100-meter level to 3°4. Yet 8 of the 10 species were confined to the two lower levels and only the 2 species of *Calanus* were found at the surface. The fact that these 2 species were found at the surface shows

that some of them become positively phototropic at low temperatures, but they were also abundant at the two lower levels, showing that not all of them were so affected. This is the second of the two Atlantic records for *Pareuchaeta tonsa*, the first having been made at station 11, above.

STATION 13

August 7, 1928; 46° 06' N, 48° 01' W; bottom depth, 126 m; 13 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	11.3	1.6	1.2	Density (σ_{tP})	24.9	26.8	27.0
Salinity, o/oo	32.6	33.3	33.6	Hydrogen-ion conc. (pH)	8.09	7.87	7.87
<i>Calanus finmarchicus</i>	f	a	a	<i>Microsetella norvegica</i>.....	..	f	f
<i>helgolandicus</i>	f	..	r	<i>Oithona similis</i>	a	f	a
<i>minor</i>.....	..	..	f	<i>spirostris</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>.....	..	..	r	<i>Oithonina nana</i>	a	f	a
<i>Eucalanus elongatus</i>.....	..	c	f	<i>Paracalanus parvus</i>.....	..	c	c
<i>Megacalanus longicornis</i>.....	..	r	r	<i>Pseudocalanus minutus</i>.....	..	c	c
<i>Metridia longa</i>.....	..	..	f				

This was the shallowest station for the entire cruise, with the bottom only 26 meters below the lowest tow. It was also the coldest station, the temperature dropping at the 50-meter level to 1°6, and at the 100-meter level to 1°2. Yet only 4 of

the 13 species appeared in the surface tow, 8 in the 50-meter tow, and all 13 in the 100-meter tow. There were many development stages of *Oithona similis* and *Oithonina nana* at the surface.

BETWEEN STATIONS 13 AND 14
August 8, 1928; 42° 27' N, 47° 06.5 W; 18 species

Calanus minor.....	c	Microcalanus pusillus.....	f	Pleuromamma gracilis.....	a
Corycaeus agilis.....	r	Microsetella norvegica.....	r	Pontellina plumata.....	r
crassiusculus.....	f	Oncaea media.....	f	Pseudocalanus minutus.....	c
Farranula carinata.....	r	minuta.....	c	Sapphirina angusta.....	f
rostrata.....	r	venusta.....	f	Temora longicornis.....	4
Macrosetella gracilis.....	r	Paracalanus parvus.....	f	styliifera.....	f

This nocturnal surface tow yielded 7 species that were not found at either of the stations between which it was taken. On the other hand, 25 of the species obtained at one or both of those stations were not present in this surface tow. This tow was taken during the first part of the night, from 6^h41^m

P.M. to 12^h50^m A.M. At stations 8 to 13 neither *Corycaeus*, *Farranula*, nor *Oncaea* was present; all three were found in this tow, and the two latter genera were taken also at station 14, and all of them later. This latitude may therefore be taken as approximately the northern limit for these genera.

STATION 14
August 9, 1928; 42° 10' N, 47° 19' W; bottom depth, 4154 m; 32 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	21.1	14.9	14.0	Density (σ_{tP})	24.6	26.3	27.1
Salinity, o/oo	35.2	35.1	35.5	Hydrogen-ion conc. (pH)	8.18	8.18	8.06

Acartia longiremis.....	..	..	r	Haloptilus longicornis.....	..	..	r
Aetideus armatus.....	..	..	f	Mecynocera clausi.....	..	a	c
Calanus finmarchicus.....	..	c	..	Microcalanus pusillus.....	..	f	..
helgolandicus.....	..	r	..	Microsetella norvegica.....	..	..	r
minor.....	..	f	c	Neocalanus gracilis.....	..	..	a
Calocalanus pavo.....	..	r	r	tenuicornis.....	..	a	a
styliremis.....	..	f	..	Oithona similis.....	..	a	a
Candacia norvegica.....	..	r	..	Oncaea venusta.....	..	a	a
Centropages furcatus.....	..	..	c	Paracalanus parvus.....	c	a	a
hamatus.....	..	..	r	Pseudocalanus minutus.....	r	c	c
violaceus.....	r	f	f	Rhincalanus cornutus.....	..	..	r
Clausocalanus arcuicornis.....	a	c	c	nasutus.....	..	..	r
Eucalanus elongatus.....	..	..	r	Sapphirina angusta.....	..	..	f
Euchirella brevis.....	..	r	..	Scolecithrix danae.....	..	f	f
Farranula carinata.....	..	r	..	Temora longicornis.....	..	..	f
rostrata.....	..	f	..	styliifera.....	r	r	f

This station, with the two which immediately follow, is in the Gulf Stream, which was here crossed by the *Carnegie* nearly at right angles. Consequently the surface temperature was high, but fell 33 per cent in the upper 100 meters; the salinity and hydrogen-ion concentration, however, were practically constant at all three depths. In spite of the warmer surface temperature, only 5 species appeared in the surface

tow, whereas 20 were present in the 50-meter tow and 25 in the 100-meter tow. Nineteen species (60 per cent) were confined to a single depth and only 5 were found at all three depths. *Clausocalanus* constituted the great bulk of the surface catch, but was considerably less numerous at the two lower depths. It is also worthy of note that every species was represented by more than 5 individuals.

STATION 15

August 11, 1928; 38° 39' N, 48° 48' W; bottom depth, 5408 m; 34 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	24.8	19.8	Density (σ_{tP})	24.4	26.1
Salinity, o/oo	36.3	36.4	Hydrogen-ion concentration (pH)	8.21	8.21

<i>Acartia longiremis</i>.....	..	f	<i>Haloptilus longicornis</i>.....	..	c
<i>Calanus minor</i>	f	c	<i>Heterorhabdus papilliger</i>.....	..	f
<i>Calocalanus pavo</i>.....	..	f	<i>Lubbockia aculeata</i>.....	..	2
<i>styliremis</i>.....	..	r	<i>squillimana</i>.....	..	r
<i>Candacia norvegica</i>.....	..	r	<i>Lucicutia flavicornis</i>.....	..	a
<i>simplex</i>.....	..	c	<i>Mecynocera clausi</i>.....	..	f
<i>Centropages furcatus</i>.....	..	f	<i>Microsetella norvegica</i>.....	..	f
<i>violaceus</i>	f	..	<i>Neocalanus gracilis</i>.....	..	r
<i>Clausocalanus arcuicornis</i>	a	c	<i>tenuicornis</i>.....	..	f
<i>Corycaeus crassiusculus</i>	f	c	<i>Oithona similis</i>.....	..	a
<i>lautus</i>.....	..	f	<i>spinirostris</i>.....	..	r
<i>speciosus</i>.....	..	f	<i>Oncaea minuta</i>.....	..	c
<i>typicus</i>.....	..	f	<i>venusta</i>.....	..	a
<i>Euchirella brevis</i>.....	..	r	<i>Paracalanus parvus</i>.....	..	a
<i>Farranula carinata</i>	f	a	<i>Pontellina plumata</i>.....	..	r
<i>gibbula</i>	c	f	<i>Rhincalanus cornutus</i>.....	..	r
<i>rostrata</i>	f	..	<i>nasutus</i>.....	..	r

This is the second of the three Gulf Stream stations. The temperature at the surface was more than 3.5 higher than at station 14, but fell only 20 per cent at the 50-meter level; both the salinity and the hydrogen-ion concentration were rather high and remained constant. Seven species were taken at the surface and 32 in the 50-meter tow; 29 species, or 85

per cent, were confined to a single depth, and only 5 were found at both depths. This was the only Atlantic record for *Lubbockia aculeata* and one of three for *Heterorhabdus papilliger*. The 3 species of *Farranula* and 1 species of *Corycaeus* were found at the surface; the other 3 species of *Corycaeus*, with *Oithona* and *Oncaea*, were confined to the 50-meter tow.

STATION 16

August 13, 1928; 36° 47' N, 46° 31' W; bottom depth, 5287 m; 32 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	25.9	24.4	19.9	Density (σ_{tP})	23.9	24.8	26.3
Salinity, o/oo	36.1	36.3	36.4	Hydrogen-ion conc. (pH)	8.24	8.23	8.17

<i>Calanus minor</i>	c	..	..	<i>Macrosetella oculata</i>.....	..	r	..
<i>Calocalanus pavo</i>	f	r	..	<i>Mecynocera clausi</i>.....	..	c	f
<i>styliremis</i>.....	..	r	r	<i>Microsetella norvegica</i>	f	r	r
<i>Candacia bispinosa</i>.....	..	r	..	<i>rosea</i>.....	..	..	r
<i>Centropages furcatus</i>	r	..	..	<i>Miracia efferata</i>	c	..	r
<i>Clausocalanus arcuicornis</i>	f	..	..	<i>Neocalanus gracilis</i>	f	..	..
<i>Corycaeus crassiusculus</i>	f	..	..	<i>tenuicornis</i>.....	..	..	r
<i>limbatus</i>.....	..	f	..	<i>Oithona similis</i>.....	..	c	a
<i>speciosus</i>.....	..	c	..	<i>spinirostris</i>.....	..	r	..
<i>Euchaeta marina</i>.....	..	r	..	<i>Oncaea minuta</i>.....	..	..	f
<i>Farranula carinata</i>	a	..	c	<i>venusta</i>.....	..	r	..
<i>gibbula</i>	f	1	..	<i>Paracalanus parvus</i>.....	..	c	f
<i>rostrata</i>	r	..	c	<i>Pontellina plumata</i>	r	r	..
<i>Haloptilus longicornis</i>.....	..	..	r	<i>Pontellopsis perspicax</i>	r	..	..
<i>Lucicutia flavicornis</i>.....	..	..	r	<i>Pseudocalanus minutus</i>.....	..	a	c
<i>Macrosetella gracilis</i>	f	c	..	<i>Rhincalanus nasutus</i>.....	..	r	..

This is the third Gulf Stream station. The surface temperature was 1° higher than before and dropped almost 24 per cent in 100 meters; the salinity and hydrogen-ion concentration were high and nearly constant. The vertical distribution was very different: 14 species at the surface, 18 in the 50-meter tow, and 14 in the 100-meter tow. Nineteen species (60 per

cent) were confined to a single tow, and only 1 appeared in all three tows. This is another record in which every one of the species is well represented. Again the 3 species of *Farranula* and 1 species of *Corycaeus* appeared at the surface; the other 2 *Corycaeus* species with *Oithona* and *Oncaea* were confined to the two deeper tows.

STATION 17

August 15, 1928; 33° 42' N, 42° 21' W; bottom depth, 4492 m; 28 species

Depth of tow, m	50	100	Depth of tow, m	50	100
Temperature, °C	21.9	19.3	Density (σ_{tP})	25.7	26.5
Salinity, o/oo	36.6	36.5	Hydrogen-ion concentration (pH)	8.27	8.22

<i>Acartia longiremis</i>.....	..	f	<i>Farranula rostrata</i>	c	f
<i>Calanus helgolandicus</i>.....	..	c	<i>Haloptilus longicornis</i>	r	..
<i>minor</i>	c	c	<i>Lubbockia squillimana</i>	r	r
<i>Candacia aethiopica</i>	r	..	<i>Lucicutia clausii</i>.....	..	f
<i>bispinosa</i>	r	..	<i>flavicornis</i>	c	c
<i>simplex</i>	f	..	<i>Macrosetella oculata</i>	r	..
<i>Centropages furcatus</i>	r	..	<i>Microcalanus pusillus</i>.....	..	f
<i>violaceus</i>	r	..	<i>Microsetella norvegica</i>	r	..
<i>Clausocalanus arcuicornis</i>	f	..	<i>Neocalanus gracilis</i>	f	..
<i>Corycaeus crassiusculus</i>	c	..	<i>tenuicornis</i>	f	..
<i>speciosus</i>	c	a	<i>Oithona similis</i>.....	..	c
<i>Euchirella brevis</i>.....	..	r	<i>spinirostris</i>.....	..	c
<i>Farranula carinata</i>.....	..	a	<i>Oncaea media</i>.....	..	a
<i>gibbula</i>	f	..	<i>venusta</i>.....	..	a

This is the first station in the Sargasso Sea whose waters show a relatively high salinity. Eighteen species were found in the 50-meter tow and 15 in the 100-meter tow; only 5 species were found in both tows, 23 (82 per cent) being con-

fined to one tow. The surface tow from this station was lost. *Corycaeus* and *Farranula* appeared in both the deeper tows, but *Oithona* and *Oncaea* were confined to the 100-meter tow. *Candacia* and *Centropages* were found only in the 50-meter tow.

STATION 18

August 17, 1928; 29° 47' N, 40° 36' W; bottom depth, 4054 m; 33 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	26.9	22.3	20.3	Density (σ_{tp})	24.2	25.7	26.5
Salinity, o/oo	36.5	36.8	36.8	Hydrogen-ion conc. (pH)	8.23	8.24	8.21
<i>Acartia longiremis</i>.....	..	..	r	<i>Lucicutia flavicornis</i>.....	..	..	c
<i>Aetideus armatus</i>.....	..	..	r	<i>longicornis</i>	r	..	r
<i>Calanus helgolandicus</i>.....	..	c	a	<i>Macrosetella gracilis</i>	f	..	..
<i>minor</i>.....	..	..	c	<i>Mecynocera clausi</i>	f	..	r
<i>Calocalanus pavo</i>.....	..	..	f	<i>Microcalanus pusillus</i>.....	..	f	c
<i>Candacia simplex</i>.....	..	..	f	<i>Microsetella norvegica</i>	f	..	..
<i>Centropages furcatus</i>.....	..	f	f	<i>Miracia efferata</i>	r	..	..
<i>Corycaeus crassiusculus</i>	a	..	c	<i>Oithona similis</i>.....	..	a	..
<i>pumilus</i>.....	..	f	..	<i>spinirostris</i>.....	..	..	c
<i>speciosus</i>	c	c	a	<i>Oncaea minuta</i>.....	..	f	a
<i>Euchirella brevis</i>.....	..	r	..	<i>venusta</i>	a	a	a
<i>Farranula carinata</i>	a	a	a	<i>Paracalanus parvus</i>.....	..	c	..
<i>gibbula</i>.....	..	f	..	<i>Pontellina plumata</i>.....	..	..	r
<i>rostrata</i>.....	..	c	..	<i>Pseudocalanus minutus</i>.....	..	c	c
<i>Haloptilus longicornis</i>.....	..	..	c	<i>Rhincalanus nasutus</i>.....	..	..	r
<i>Lubbockia squillimana</i>.....	..	..	f	<i>Sapphirina auronitens</i>	r	..	..
<i>Lucicutia clausii</i>	c	r	c				

The temperature was quite high at the surface, but fell 30 per cent at the 100-meter level; the salinity and hydrogen-ion concentration were also high and remained practically unchanged. Eleven species were found at the surface, 15 at 50 meters, and 23 at 100 meters. Only 4 species were found in all three tows, and 21 (63 per cent) were confined to a single

tow. This tow was taken late in the forenoon, and it is worthy of note that *Acartia*, *Aetideus*, *Calocalanus*, *Candacia*, *Haloptilus*, *Lubbockia*, *Pontellina*, and *Rhincalanus* were all confined to the 100-meter depth. If the tows had been taken at the usual time, earlier in the morning, probably some of these genera would have been found nearer the surface.

STATION 19

August 20, 1928; 24° 00' N, 39° 36' W; bottom depth, 5392 m; 50 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	26.6	25.2	22.3	Density (σ_{t})	24.3	25.1	26.1
Salinity, o/oo	36.9	37.1	37.0	Hydrogen-ion conc. (pH)	8.34	8.27	8.25

<i>Acartia longiremis</i>	f	r	..	<i>Haloptilus plumosus</i>.....	..	..	r
<i>Aetideus armatus</i>.....	..	..	r	<i>Lubbockia squillimana</i>.....	..	r	r
<i>Calanus helgolandicus</i>	c	(a)	c	<i>Lucicutia clausii</i>.....	..	f	..
<i>minor</i>	c	r	..	<i>flavicornis</i>.....	..	..	(a)
<i>Calocalanus pavo</i>	c	..	r	<i>longicornis</i>.....	..	..	c
<i>styliremis</i>	c	r	r	<i>Macrosetella gracilis</i>	f	f	f
<i>Candacia bispinosa</i>.....	..	..	f	<i>oculata</i>.....	..	r	r
<i>norvegica</i>.....	..	..	f	<i>Mecynocera clausi</i>.....	..	r	r
<i>simplex</i>.....	..	r	..	<i>Megacalanus longicornis</i>.....	..	r	..
<i>Centropages furcatus</i>	r	..	r	<i>Microcalanus pusillus</i>.....	..	..	f
<i>hamatus</i>	r	..	..	<i>Microsetella norvegica</i>.....	..	f	f
<i>Clausocalanus arcuicornis</i>	f	f	..	<i>Miracia efferata</i>	r	r	r
<i>Clytemnestra scutellata</i>.....	..	..	r	<i>Oithona plumifera</i>.....	..	..	r
<i>Copilia denticulata</i>.....	..	r	..	<i>similis</i>.....	..	c	a
<i>Corycaeus crassiusculus</i>.....	..	f	..	<i>spirostris</i>.....	..	f	a
<i>lautus</i>	l	..	..	<i>Oithonina nana</i>	f	f	r
<i>pumilus</i>	f	..	..	<i>Oncaea media</i>.....	..	r	..
<i>speciosus</i>	a	f	c	<i>minuta</i>	c	f	c
<i>Euchaeta marina</i>.....	..	..	r	<i>venusta</i>	a	..	a
<i>Euchirella rostrata</i>.....	..	r	..	<i>Paracalanus parvus</i>	c	c	f
<i>Farranula carinata</i>	a	c	..	<i>Pseudocalanus minutus</i>	f	c	f
<i>gibbula</i>	c	..	..	<i>Rhincalanus cornutus</i>.....	..	r	r
<i>rostrata</i>.....	..	..	r	<i>Sapphirina angusta</i>.....	..	..	r
<i>Haloptilus longicornis</i>.....	..	f	a	<i>auronitens</i>	f	..	..
<i>ornatus</i>.....	..	r	..	<i>Undinula vulgaris</i>.....	..	..	r

The temperature was still high at the surface and varied only 4° in the upper 100 meters; the salinity and hydrogen-ion concentration were very high and varied scarcely at all. The vertical distribution was more even, with 22 species at the surface, 29 at 50 meters, and 33 at 100 meters. Ten of these species were found in all three tows, and 26 (52 per cent) were

confined to a single tow. This is the only Atlantic record for *Haloptilus plumosus* and the one locality where *Lucicutia longicornis* was present in sufficient numbers to be called common. *Corycaeus*, *Farranula*, *Oithona*, and *Oncaea* were each well represented in the surface tow.

STATION 20

August 22, 1928; 19° 13' N, 38° 28' W; bottom depth, 5626 m; 12 species

<i>Acartia longiremis</i>	r	<i>Corycaeus dubius</i>	2	<i>Farranula rostrata</i>	r
<i>Calocalanus pavo</i>	f	<i>speciosus</i>	f	<i>Macrosetella gracilis</i>	f
<i>styliremis</i>	f	<i>Farranula carinata</i>	a	<i>Oncaea minuta</i>	r
<i>Candacia bispinosa</i>	r	<i>gibbula</i>	f	<i>Paracalanus parvus</i>	r

The surface tow was the only one taken at this station, with temperature 26°, salinity 36.5 o/oo, and hydrogen-ion concentration 8.37. This station still shows a high temperature and high salinity. Although but 12 species are recorded, it must

be remembered that this was a surface tow, for which 12 is a very fair record. If the two other tows had been taken there is no doubt that the total number of species recorded for this station would have been much larger.

BETWEEN STATIONS 20 AND 21
August 23, 1928; 16° 01' N, 37° 52' W; 26 species

<i>Acartia longiremis</i>	f	<i>Corycaeus typicus</i>	f	<i>Miracia efferata</i>	f
<i>Calanus minor</i>	a	<i>Euchaeta marina</i>	f	<i>Oncaea venusta</i>	a
<i>propinquus</i>	f	<i>Euchirella brevis</i>	r	<i>Paracalanus parvus</i>	c
<i>Calocalanus pavo</i>	r	<i>Farranula carinata</i>	a	<i>Pleuromamma xiphias</i>	r
<i>Candacia bispinosa</i>	f	<i>gibbula</i>	f	<i>Pseudocalanus minutus</i>	c
<i>simplex</i>	r	<i>gracilis</i>	3	<i>Sapphirina auronitens</i>	f
<i>Centropages furcatus</i>	r	<i>rostrata</i>	f	<i>Scolecithrix danae</i>	a
<i>Corycaeus clausi</i>	1	<i>Lucicutia clausii</i>	a	<i>Undinula vulgaris</i>	a
<i>speciosus</i>	f	<i>longicornis</i>	f		

This surface tow was taken in the night. It contains 12 species which were not found at either station 20 or station 21, and is the only Atlantic record for *Pleuromamma xiphias*.

It thus furnishes good evidence of the nocturnal migration of these species to the surface, and suggests that they may have been present at the regular stations below the depths of tows.

STATION 21
August 24, 1928; 15° 50' N, 37° 56' W; bottom depth, 4977 m; 30 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	26.5	24.4	21.0	Density (σ_{tP})	23.8	24.7	26.2
Salinity, o/oo	36.2	36.2	36.7	Hydrogen-ion conc. (pH)	8.32	8.25	8.20

<i>Acartia longiremis</i>.....	..	f	..	<i>Megacalanus longicornis</i>.....	..	r	..
<i>Calanus helgolandicus</i>	c	a	f	<i>Microcalanus pusillus</i>	f	f	..
<i>minor</i>	c	a	c	<i>Oithona plumifera</i>.....	..	r	..
<i>propinquus</i>.....	..	r	..	<i>similis</i>.....	..	a	a
<i>Calocalanus pavo</i>	2	..	..	<i>spinirostris</i>.....	..	..	f
<i>styliremis</i>	f	r	..	<i>Oncaea conifera</i>	f	..	..
<i>Candacia bispinosa</i>	a	r	..	<i>curta</i>	3	..	..
<i>Clausocalanus arcuicornis</i>.....	..	r	..	<i>media</i>	c	f	..
<i>Corycaeus speciosus</i>	r	r	..	<i>minuta</i>	f	..	..
<i>Euchaeta marina</i>	f	f	r	<i>notopa</i>.....	..	1	..
<i>Farranula carinata</i>	a	..	f	<i>venusta</i>	a	c	c
<i>gibbula</i>	f	..	..	<i>Paracalanus parvus</i>.....	..	..	c
<i>rostrata</i>	f	..	..	<i>Pseudocalanus minutus</i>.....	..	..	c
<i>Macrosetella gracilis</i>	r	..	..	<i>Scolecithrix danae</i>.....	..	r	..
<i>Mecynocera clausi</i>.....	..	r	r	<i>Spinocalanus abyssalis</i>.....	..	..	r

The temperature was high at the surface, and dropped 2° to the 50-meter level and 5.5 to the 100-meter level. There were 17 species in the surface tow, 18 in the 50-meter tow, and 11 in the 100-meter tow. Eighteen species (60 per cent) were

confined to a single tow and only 4 were found in all three tows. The surface tow was especially rich in species of *Oncaea*, the 50-meter tow in species of *Calanus*, and the 100-meter tow in species of *Oithona*.

STATION 22

August 27, 1928; 13° 25' N, 38° 00' W; bottom depth, 5980 m; 34 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	26.7	24.5	17.5	Density (σ_{tp})	23.5	24.6	26.7
Salinity, o/oo	35.9	36.1	36.1	Hydrogen-ion conc. (pH)	8.26	8.21	7.99

<i>Acartia longiremis</i>.....	..	f	c	<i>Macrosetella gracilis</i>	c	f	r
<i>Calanus helgolandicus</i>	c	c	f	<i>Mecynocera clausi</i>.....	..	r	r
<i>minor</i>	f	c	c	<i>Megacalanus longicornis</i>.....	..	c	..
<i>Candacia bispinosa</i>	r	r	r	<i>Microcalanus pusillus</i>.....	..	f	r
<i>Centropages furcatus</i>.....	..	..	r	<i>Microsetella norvegica</i>.....	..	..	r
<i>Corycaeus crassiusculus</i>	f	..	..	<i>Oithona similis</i>.....	..	..	f
<i>dubius</i>	f	..	..	<i>spinirostris</i>.....	..	a	r
<i>lautus</i>	2	..	..	<i>Oithonina nana</i>.....	..	a	r
<i>pumilus</i>.....	..	a	..	<i>Oncaea minuta</i>.....	..	..	r
<i>speciosus</i>	f	r	..	<i>similis</i>	f	a	..
<i>Euchaeta marina</i>.....	..	f	r	<i>tenella</i>	1	..	..
<i>Euchirella rostrata</i>.....	..	r	..	<i>venusta</i>	a	..	c
<i>Farranula carinata</i>	a	a	f	<i>Paracalanus parvus</i>.....	..	f	c
<i>gibbula</i>	f	..	..	<i>Pontellina plumata</i>.....	..	r	..
<i>Haloptilus longicornis</i>.....	..	r	..	<i>Pseudocalanus minutus</i>.....	..	f	r
<i>Lucicutia clausii</i>.....	..	r	f	<i>Scolecithrix danae</i>	r	r	r
<i>flavicornis</i>.....	..	..	r	<i>Undinula vulgaris</i>.....	..	r	..

The temperature was high at the surface but dropped 2° at 50 meters and 9° at 100 meters; the salinity and hydrogen-ion concentration were high, with little variation at the three depths. Fourteen species were found at the surface, 23 in the

50-meter tow, and 21 in the 100-meter tow. Sixteen (47 per cent) were confined to a single tow and only 6 were present in all tows. The small species of *Corycaeus*, *Farranula*, and *Oncaea* were abundant in the surface tow, but *Oithona* was absent.

STATION 23

August 29, 1928; 10° 50' N, 37° 24' W; bottom depth, 4787 m; 60 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.1	20.9	16.5	Density (σ_{tP})	23.3	25.5	26.8
Salinity, o/oo	35.9	36.0	36.0	Hydrogen-ion conc. (pH)	8.25	8.14	8.18
<i>Acartia longiremis</i>.....	..	c	a	<i>Lucicutia clausii</i>.....	..	..	r
<i>Calanus helgolandicus</i>	a	..	c	<i>flavicornis</i>.....	..	..	a
<i>minor</i>.....	..	c	c	<i>Macrosetella gracilis</i>	f	f	f
<i>Calocalanus pavo</i>	r	..	..	<i>Mecynocera clausi</i>	r	r	..
<i>Candacia aethiopica</i>.....	..	r	..	<i>Megacalanus longicornis</i>.....	..	r	..
<i>bispinosa</i>	a	r	..	<i>Metridia longa</i>.....	..	r	..
<i>falcifera</i>.....	..	..	2 ♀	<i>Microcalanus pusillus</i>	f	r	..
<i>simplex</i>	f	f	f	<i>Microsetella norvegica</i>	f	..	c
<i>varicans</i>.....	..	..	f	<i>Miracia efferata</i>	f	r	..
<i>Centraugaptilus rattrayi</i>.....	..	..	r	<i>Oithona setiger</i>.....	..	..	r
<i>Centropages furcatus</i>	f	..	..	<i>similis</i>.....	..	f	f
<i>Copilia denticulata</i>	r	..	..	<i>spirostris</i>.....	..	f	f
<i>Corycaeus agilis</i>	f	..	..	<i>Oithonina nana</i>.....	..	..	r
<i>crassiusculus</i>	c	c	c	<i>Oncaea conifera</i>	f	..	..
<i>lautus</i>.....	±	..	..	<i>media</i>	c	..	..
<i>pumilus</i>	f	f	..	<i>minuta</i>	a	c	f
<i>speciosus</i>	a	f	f	<i>notopa</i>	r	..	..
<i>typicus</i>	f	..	..	<i>tenella</i>	2	..	..
<i>Eucalanus elongatus</i>.....	..	r	..	<i>venusta</i>	a	a	c
<i>Euchaeta marina</i>.....	..	c	r	<i>Paracalanus parvus</i>	c	c	f
<i>Euchirella brevis</i>	f	..	r	<i>Phaenna spinifera</i>.....	..	c	r
<i>Farranula carinata</i>	a	c	f	<i>Pontellina plumata</i>	r	r	..
<i>curta</i>	r	..	..	<i>Pontellopsis perspicax</i>	r	..	..
<i>gibbula</i>	c	..	..	<i>regalis</i>	r	..	..
<i>gracilis</i>	f	..	..	<i>Pseudocalanus minutus</i>.....	..	c	f
<i>rostrata</i>.....	..	..	r	<i>Rhincalanus nasutus</i>.....	..	..	r
<i>Haloptilus longicornis</i>.....	..	..	r	<i>Sapphirina angusta</i>.....	..	r	..
<i>ornatus</i>.....	..	..	f	<i>Scolecithrix danae</i>.....	..	a	..
<i>Heterorhabdus papilliger</i>	r	r	r	<i>Spinocalanus abyssalis</i>.....	..	r	..
<i>Labidocera nerii</i>	r	..	..	<i>Undinula vulgaris</i>.....	..	c	..

The temperature, high at the surface, dropped about 6° at a depth of 50 meters and an additional 4.4° at 100 meters. The number of species is increased to 60, 34 of which were found at the surface, 30 in the 50-meter tow, and 30 in the 100-meter tow. Thirty-five (58 per cent) were confined to a single depth and 9 were found at all three depths. Species of *Cory-*

caeus and *Oncaea* were again especially abundant at the surface, and this tow contained one of the two Atlantic records of *Pontellopsis regalis*; the other was made at station 24 below; the species is rare at both stations. In the 100-meter tow we find the only record of *Centraugaptilus rattrayi* and of *Candacia falcifera* for the cruise.

STATION 24

August 31, 1928; 8° 15' N, 36° 10' W; bottom depth, 3836 m; 50 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.1	23.1	15.5	Density (σ_{tP})	22.8	24.9	26.8
Salinity, o/oo	35.2	36.0	35.6	Hydrogen-ion conc. (pH)	8.32	8.14	7.96

<i>Acartia longiremis</i>.....	..	c	..	<i>Heterorhabdus papilliger</i>.....	..	..	r
<i>Aetideus armatus</i>.....	..	..	r	<i>Lucicutia clausii</i>.....	..	..	a
<i>Calanus helgolandicus</i>	c	a	c	<i>flavicornis</i>.....	..	..	c
<i>minor</i>.....	..	a	c	<i>Macrosetella gracilis</i>	c	f	c
<i>propinquus</i>.....	..	a	r	<i>Mecynocera clausi</i>.....	..	f	..
<i>Calocalanus pavo</i>	f	..	..	<i>Megacalanus longicornis</i>.....	..	a	f
<i>styliremis</i>	r	..	..	<i>Microcalanus pusillus</i>.....	..	f	c
<i>Candacia bispinosa</i>.....	..	c	..	<i>pygmaeus</i>.....	..	..	f
<i>norvegica</i>.....	..	r	..	<i>Microsetella norvegica</i>.....	..	f	c
<i>pachydactyla</i>	f	f	..	<i>Miracia efferata</i>	a	..	r
<i>simplex</i>	f	..	..	<i>Oithona similis</i>.....	..	f	c
<i>varicans</i>.....	..	f	f	<i>spinirostris</i>.....	..	f	f
<i>Centropages furcatus</i>	r	..	r	<i>Oithonina nana</i>.....	..	f	..
<i>Clytemnestra scutellata</i>.....	..	f	r	<i>Oncaea media</i>.....	..	..	f
<i>Corycaeus crassiusculus</i>.....	..	f	..	<i>minuta</i>.....	..	f	a
<i>speciosus</i>	f	f	f	<i>notopa</i>.....	..	..	r
<i>typicus</i>.....	..	f	..	<i>venusta</i>	c	f	a
<i>Eucalanus elongatus</i>.....	..	c	f	<i>Paracalanus parvus</i>	c	..	..
<i>Euchaeta marina</i>.....	..	a	c	<i>Pareuchaeta grandiremis</i>.....	..	..	r
<i>Euchirella brevis</i>.....	..	c	r	<i>Phaenna spinifera</i>.....	..	f	r
<i>Farranula carinata</i>	a	..	a	<i>Pontellopsis regalis</i>	r	..	..
<i>gibbula</i>	c	..	..	<i>Pseudocalanus minutus</i>.....	..	c	c
<i>rostrata</i>.....	..	..	f	<i>Rhincalanus cornutus</i>.....	..	r	r
<i>Haloptilus longicornis</i>.....	..	..	c	<i>Scolecithrix danac</i>.....	..	a	c
<i>ornatus</i>.....	..	..	c	<i>Undinula vulgaris</i>.....	..	a	r

The temperature here dropped 4° in 50 meters from a high value at the surface, and 8° more at the 100-meter level. Fourteen species were found at the surface, 30 in the 50-meter tow, and 36 in the 100-meter tow. Twenty-three species (46 per cent) were confined to a single depth and only 4 were present in all three tows. In contrast with the preceding

records, *Corycaeus* and *Oncaea* are each represented by a single species in the surface tow, but the former is better represented in the 50-meter tow and the latter becomes very abundant in the 100-meter tow. This last tow also contains the only record of *Pareuchaeta grandiremis* and one of two Atlantic records of *Microcalanus pygmaeus*.

STATION 25

September 3, 1928; 11° 02' N, 37° 06' W; bottom depth, 4851 m; 31 species

Depth of tow, m	0	100	Depth of tow, m	0	100
Temperature, °C	27.4	14.6	Density (σ_{tP})	23.0	27.0
Salinity, o/oo	35.5	35.7	Hydrogen-ion concentration (pH)	8.31	7.93

<i>Acartia longiremis</i>.....	..	a	<i>Megacalanus longicornis</i>.....	..	c
<i>Calanus helgolandicus</i>	c	c	<i>Microcalanus pusillus</i>.....	..	f
<i>minor</i>.....	..	c	<i>pygmaeus</i>.....	..	r
<i>Calocalanus pavo</i>	f	..	<i>Miracia efferata</i>	c	..
<i>styliremis</i>	r	..	<i>Oithona plumifera</i>.....	..	f
<i>Candacia bispinosa</i>	r	c	<i>similis</i>.....	..	r
<i>varicans</i>.....	..	r	<i>spirostris</i>.....	..	r
<i>Corycaeus agilis</i>	c	..	<i>Oncaea media</i>	f	..
<i>crassiusculus</i>	a	..	<i>minuta</i>	a	..
<i>limbatus</i>	f	..	<i>venusta</i>	a	c
<i>speciosus</i>	a	..	<i>Paracalanus parvus</i>	f	c
<i>Euchaeta marina</i>.....	..	c	<i>Pontellina plumata</i>	f	..
<i>Farranula carinata</i>	a	..	<i>Pontellopsis perspicax</i>	r	..
<i>Lucicutia clausii</i>.....	..	f	<i>Pseudocalanus minutus</i>.....	..	c
<i>Macrosetella gracilis</i>.....	..	f	<i>Temora stylifera</i>.....	..	f
<i>Mecynocera clausi</i>.....	..	r			

The high surface temperature dropped almost 50 per cent at a depth of 100 meters, but the salinity remained practically the same and the hydrogen-ion concentration dropped 0.4 of a point. Sixteen species were found at the surface and 19

at the 100-meter level, and only 4 species were present in both tows. The 100-meter tow contains the second Atlantic record of *Microcalanus pygmaeus*, the two thus occurring at adjacent stations.

STATION 26

September 5, 1928; 11° 33' N, 40° 43' W; bottom depth, 4492 m; 6 species

<i>Calocalanus pavo</i>	c	<i>Corycaeus speciosus</i>	f	<i>Macrosetella gracilis</i>	c
<i>Corycaeus crassiusculus</i>	f	<i>Farranula carinata</i>	f	<i>Oncaea venusta</i>	f

Towing was done at the surface only, with temperature 27°6, salinity 36 o/oo, and hydrogen-ion concentration 8.30. Owing to very bad conditions, heavy tide rips, strong cross-currents, and a rolling sea, the two deeper tows had to be

omitted. This is a smaller record than that for station 10, but this is one tow only, taken under very adverse conditions, whereas at station 10 all three tows were taken under good conditions.

STATION 27

September 7, 1928; 11° 20' N, 44° 12' W; bottom depth, 2571 m; 41 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.5	26.0	17.7	Density (σ_{tP})	23.5	24.2	26.5
Salinity, o/oo	36.2	36.2	36.0	Hydrogen-ion conc. (pH)	8.31	8.30	8.09

<i>Acartia longiremis</i>.....	..	a	f	<i>Macrosetella gracilis</i>	c	c	a
<i>Calanopia americana</i>.....	..	r	..	<i>Mecynocera clausi</i>.....	..	r	r
<i>Calanus helgolandicus</i>	c	a	f	<i>Megacalanus longicornis</i>.....	..	f	r
<i>minor</i>	f	a	..	<i>Microcalanus pusillus</i>.....	..	f	..
<i>Calocalanus pavo</i>.....	..	f	f	<i>Microsetella norvegica</i>	f	c	a
<i>Candacia bispinosa</i>.....	..	f	..	<i>Miracia efferata</i>	f	..	..
<i>pachydactyla</i>.....	..	f	..	<i>Oithona plumifera</i>.....	..	f	a
<i>simplex</i>.....	..	f	r	<i>similis</i>.....	..	a	a
<i>Clytemnestra scutellata</i>.....	..	f	..	<i>spirostris</i>.....	..	f	a
<i>Corycaeus crassiusculus</i>.....	..	..	f	<i>Oithonina nana</i>.....	..	c	a
<i>speciosus</i>	f	a	c	<i>Oncaea minuta</i>.....	..	f	c
<i>Eucalanus elongatus</i>.....	..	r	..	<i>venusta</i>	c	a	c
<i>Euchaeta marina</i>.....	..	r	f	<i>Paracalanus parvus</i>.....	..	..	f
<i>Euchirella brevis</i>.....	..	r	..	<i>Phaenna spinifera</i>.....	..	f	f
<i>pulchra</i>.....	..	..	r	<i>Pontellina plumata</i>	r	r	r
<i>Farranula carinata</i>	f	c	..	<i>Pontellopsis perspicax</i>	r	..	..
<i>gibbula</i>	f	..	..	<i>Pseudocalanus minutus</i>.....	..	c	c
<i>rostrata</i>.....	..	f	f	<i>Sapphirina nigromaculata</i>.....	..	r	..
<i>Haloptilus longicornis</i>.....	..	..	c	<i>Scolecithrix danae</i>.....	..	f	r
<i>Lucicutia clausii</i>.....	..	..	f	<i>Undinula vulgaris</i>.....	..	r	r
<i>flavicornis</i>.....	..	..	f				

The temperature was high at the surface, and dropped 1°5 at 50 meters and nearly 9° more at 100 meters; the salinity remained practically unchanged, but the hydrogen-ion concentration decreased a little at 100 meters. Eleven species were found at the surface, 32 at 50 meters, and 28 at 100

meters. Seventeen species were each confined to a single tow and 6 were found in all three tows. *Macrosetella*, *Microsetella*, and *Oithona* species were especially abundant in the 100-meter tow, which contained in addition one of the two Atlantic records of *Euchirella pulchra*.

STATION 28

September 11, 1928; 13° 10' N, 49° 36' W; bottom depth, 4925 m; 44 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.6	26.7	22.8	Density (σ_{tP})	23.4	24.0	25.6
Salinity, o/oo	36.2	36.3	36.6	Hydrogen-ion conc. (pH)	8.29	8.23	8.22

<i>Acartia clausii</i>.....	..	..	r	<i>Labidocera nerii</i>	f	..	..
<i>longiremis</i>	r	..	..	<i>Lubbockia squillimana</i>.....	..	..	r
<i>Aetideus armatus</i>.....	..	r	..	<i>Lucicutia clausii</i>.....	..	c	c
<i>Calanus helgolandicus</i>	c	f	f	<i>flavicornis</i>.....	..	c	c
<i>minor</i>	c	f	..	<i>Macrosetella gracilis</i>	a	c	c
<i>propinquus</i>	f	..	..	<i>Mecynocera clausi</i>.....	..	r	r
<i>Calocalanus pavo</i>	c	r	..	<i>Megacalanus longicornis</i>.....	..	r	r
<i>Candacia aethiopica</i>	r	..	..	<i>Microcalanus pusillus</i>	r	r	..
<i>bispinosa</i>	r	r	..	<i>Microsetella norvegica</i>	a	c	c
<i>pachydactyla</i>.....	..	r	..	<i>rosea</i>.....	..	r	r
<i>Centropages furcatus</i>	r	..	r	<i>Oithona plumifera</i>.....	..	r	..
<i>hamatus</i>	r	..	..	<i>similis</i>.....	..	f	c
<i>Clausocalanus arcuicornis</i>.....	..	..	r	<i>spirostris</i>.....	..	..	r
<i>Corycaeus anglicus</i>	2	..	..	<i>Oncaea minuta</i>.....	..	c	c
<i>crassiusculus</i>	f	..	r	<i>venusta</i>	c	a	c
<i>speciosus</i>	c	f	c	<i>Paracalanus parvus</i>	f	f	c
<i>typicus</i>	f	..	..	<i>Pontellopsis perspicax</i>	r	..	..
<i>Euchirella brevis</i>.....	..	..	r	<i>Pseudocalanus minutus</i>	f	c	f
<i>Farranula carinata</i>	c	f	c	<i>Rhincalanus cornutus</i>.....	..	..	r
<i>gibbula</i>	r	..	..	<i>Sapphirina nigromaculata</i>	r	..	..
<i>rostrata</i>	c	f	f	<i>Scolecithrix danae</i>.....	..	..	f
<i>Haloptilus ornatus</i>.....	..	c	f	<i>Temora stylifera</i>	f	r	f

From a high surface temperature there was a drop of only 1° at a depth of 50 meters and 4° more at 100 meters; the salinity and hydrogen-ion concentration were also high and varied scarcely at all at the three depths. Twenty-six species were found at the surface, 25 in the 50-meter tow, and 27 in the 100-meter tow, an exceptionally uniform vertical distri-

bution. Twenty species (45 per cent) were confined to a single depth and 10 were found at all three depths. All the species of *Corycaeus* and *Farranula* appeared at the surface, but only one species of *Oncaea* and none of *Oithona*. The two species of *Acartia* were as far apart as possible, one being confined to the surface tow and the other to the 100-meter tow.

STATION 29

September 13, 1928; 13° 16' N, 52° 13' W; bottom depth, 5068 m; 37 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.5	27.1	23.1	Density (σ_{tP})	23.4	23.8	25.5
Salinity, o/oo	36.2	36.2	36.5	Hydrogen-ion conc. (pH)	8.31	8.29	8.21
<i>Calanus helgolandicus</i>.....	..	f	c	<i>Macrosetella oculata</i>.....	..	..	r
<i>minor</i>.....	..	c	c	<i>Mecynocera clausi</i>.....	..	f	r
<i>propinquus</i>.....	..	c	..	<i>Megacalanus longicornis</i>.....	..	f	r
<i>Calocalanus pavo</i>	c	f	c	<i>Microcalanus pusillus</i>	r	..	r
<i>styliremis</i>	c	..	c	<i>Microsetella norvegica</i>	f	c	f
<i>Candacia bispinosa</i>.....	..	..	r	<i>rosea</i>.....	..	..	c
<i>pachydactyla</i>.....	..	r	r	<i>Miracia efferata</i>.....	..	r	..
<i>Centropages furcatus</i>.....	..	r	r	<i>Oithona similis</i>.....	..	c	c
<i>Clytemnestra scutellata</i>.....	..	r	a	<i>spirostris</i>.....	..	f	f
<i>Corycaeus crassiusculus</i>	f	..	..	<i>Oncaea curta</i>	f	..	..
<i>speciosus</i>.....	..	c	c	<i>media</i>	f	..	..
<i>Euchaeta marina</i>.....	..	f	..	<i>minuta</i>.....	..	f	c
<i>Farranula carinata</i>.....	..	c	..	<i>venusta</i>	f	c	a
<i>gibbula</i>	f	..	..	<i>Paracalanus parvus</i>	c	..	f
<i>rostrata</i>	r	..	..	<i>Phaenna spinifera</i>.....	..	r	..
<i>Haloptilus ornatus</i>.....	..	..	c	<i>Rhincalanus cornutus</i>.....	..	..	r
<i>spiniceps</i>.....	..	r	..	<i>Scolecithrix danae</i>.....	..	f	f
<i>Lucicutia clausii</i>.....	..	..	f	<i>Undinula vulgaris</i>.....	..	f	f
<i>Macrosetella gracilis</i>	f	f	c				

The drop from a high surface temperature was less than 0.5 at 50 meters and 4° at 100 meters; the salinity and hydrogen-ion concentration were again practically unchanged and quite high. Twelve species were found at the surface, 23 at 50 meters, and 26 at 100 meters. Seventeen species (46 per cent) were confined to a single depth and only 4 were present at all

three depths. The 50-meter tow furnished the only Atlantic record for *Haloptilus spiniceps*, and most of the *Corycaeus* species were conspicuous for their absence. Two species of *Farranula*, two of *Oncaea*, and *Corycaeus crassiusculus* were confined to the surface tow, and neither species of *Oithona* appeared there at all.

STATION 30

September 15, 1928; 12° 54' N, 56° 15' W; bottom depth, 4703 m; 48 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	28.0	27.7	24.1	Density (σ_{tP})	23.2	23.5	25.1
Salinity, o/oo	36.0	36.0	36.3	Hydrogen-ion conc. (pH)	8.30	8.30	8.26
<i>Calanus helgolandicus</i>	c	f	c	<i>Macrosetella gracilis</i>	c	f	c
<i>minor</i>	f	..	c	<i>oculata</i>	r	..	..
<i>propinquus</i>.....	..	..	f	<i>Mecynocera clausi</i>.....	..	f	r
<i>Calocalanus pavo</i>	a	c	..	<i>Microcalanus pusillus</i>.....	..	..	r
<i>styliremis</i>	f	r	..	<i>Microsetella norvegica</i>	c	f	c
<i>Candacia bispinosa</i>	f	..	..	<i>rosea</i>	r	..	c
<i>pachydactyla</i>	r	..	..	<i>Oithona hebes</i>.....	..	..	r
<i>simplex</i>.....	..	..	f	<i>plumifera</i>.....	..	f	..
<i>Centropages furcatus</i>.....	..	r	..	<i>similis</i>.....	..	c	..
<i>Clytemnestra scutellata</i>.....	..	r	..	<i>spirostris</i>.....	..	..	c
<i>Corycaeus agilis</i>.....	..	r	..	<i>Oncaea curta</i>.....	..	..	r
<i>crassiusculus</i>	a	..	..	<i>media</i>.....	..	f	..
<i>dubius</i>	r	..	..	<i>minuta</i>	f	f	..
<i>lautus</i>.....	..	r	..	<i>notopa</i>.....	..	r	r
<i>limbatus</i>	r	..	..	<i>subtilis</i>	f	..	..
<i>pumilus</i>.....	..	..	r	<i>tenella</i>.....	..	..	r
<i>speciosus</i>	a	f	..	<i>venusta</i>	a	c	a
<i>Euchaeta marina</i>.....	..	..	f	<i>Paracalanus parvus</i>	f	c	c
<i>Farranula carinata</i>	c	f	f	<i>Phaenna spinifera</i>.....	..	f	..
<i>gibbula</i>.....	..	..	f	<i>Pontellopsis perspicax</i>	r	..	..
<i>rostrata</i>	r	..	r	<i>Pseudocalanus minutus</i>.....	..	c	..
<i>Haloptilus ornatus</i>.....	..	..	c	<i>Rhincalanus cornutus</i>.....	..	..	f
<i>Lucicutia clausii</i>.....	..	..	r	<i>Scolecithrix danae</i>.....	..	..	f
<i>flavicornis</i>.....	..	..	c	<i>Undinula vulgaris</i>	r	..	r

The temperature at all three depths was high and showed only 4° variation; the salinity and hydrogen-ion concentration were also high and varied extremely little. Twenty-two species were taken at the surface, 21 at 50 meters, and 28 at 100 meters. Thirty-two species (66 per cent) were each confined to a single depth and 7 were found at all three depths. The

100-meter tow contained the only record for *Oithona hebes* and the surface tow one of two Atlantic records for *Oncaea subtilis*. *Corycaeus*, *Farranula*, and *Oncaea* all appeared in goodly numbers at the surface, but no one of the four *Oithona* species was found there, two of them being confined to the 50-meter tow and the other two to the 100-meter tow.

STATION 31

October 3, 1928; 14° 46' N, 63° 26' W; bottom depth, 1635 m; 52 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	28.5	28.2	23.4	Density (σ_{tP})	21.7	22.8	25.4
Salinity, o/oo	34.4	35.3	36.4	Hydrogen-ion conc. (pH)	8.27	8.23	8.19

<i>Acartia longiremis</i>.....	..	f	..	<i>Labidocera nerii</i>.....	..	r	r
<i>Aetideus armatus</i>.....	..	..	r	<i>Lubbockia squillimana</i>.....	..	r	c
<i>Calanopia americana</i>.....	..	r	..	<i>Lucicutia flavicornis</i>.....	..	..	c
<i>Calanus helgolandicus</i>	a	..	f	<i>grandis</i>.....	..	..	r
<i>minor</i>.....	..	c	c	<i>Macrosetella gracilis</i>.....	..	c	a
<i>Calocalanus pavo</i>.....	..	r	r	<i>Mecynocera clausi</i>.....	..	..	r
<i>Candacia bispinosa</i>.....	..	r	..	<i>Microcalanus pusillus</i>.....	..	r	f
<i>norvegica</i>.....	..	..	f	<i>Microsetella norvegica</i>.....	..	c	c
<i>pachydactyla</i>.....	..	r	..	<i>rosea</i>.....	..	..	c
<i>simplex</i>.....	..	r	f	<i>Oithona plumifera</i>.....	..	f	f
<i>Clausocalanus arcuicornis</i>.....	..	f	f	<i>setiger</i>.....	..	r	r
<i>Clytemnestra scutellata</i>.....	..	r	r	<i>similis</i>.....	..	..	a
<i>Copilia denticulata</i>.....	..	r	..	<i>spirostris</i>.....	..	r	c
<i>Corycaeus anglicus</i>	r	..	..	<i>Oithonina nana</i>.....	..	f	f
<i>clausi</i>.....	..	r	..	<i>Oncaea minuta</i>.....	..	c	c
<i>crassiusculus</i>.....	..	..	a	<i>tenella</i>.....	..	r	..
<i>flaccus</i>	r	..	..	<i>venusta</i>	f	a	a
<i>minimus</i>.....	..	..	r	<i>Paracalanus parvus</i>	a	f	a
<i>speciosus</i>	f	c	..	<i>Phaenna spinifera</i>.....	..	..	f
<i>typicus</i>.....	..	f	..	<i>Pontellina plumata</i>.....	..	..	r
<i>Euchaeta marina</i>.....	..	c	f	<i>Pseudocalanus minutus</i>	a	f	c
<i>Farranula carinata</i>.....	..	c	c	<i>Rhincalanus cornutus</i>	f	f	f
<i>curta</i>	r	..	..	<i>nasutus</i>.....	..	f	f
<i>gibbula</i>.....	..	..	f	<i>Sapphirina auronitens</i>.....	..	r	..
<i>rostrata</i>.....	..	..	c	<i>Scolecithrix danae</i>.....	..	f	..
<i>Haloptilus ornatus</i>.....	..	..	f	<i>Temora stylifera</i>.....	..	f	r

A high surface temperature, with 5° drop in 100 meters; a low surface salinity, rising 2 points in 100 meters. Nine species only were found at the surface, 34 at 50 meters, and 38 at 100 meters. Twenty-seven species (52 per cent) were each confined to a single tow and only 4 were present in all three tows. The 100-meter tow contained the only record for

Lucicutia grandis and the 50-meter tow one of two Atlantic records for *Corycaeus clausi*. The small species of *Corycaeus*, *Farranula*, *Oithona*, and *Oncaea* were especially abundant in the two deeper tows. Again none of the 4 *Oithona* species, only 1 of the 4 *Farranula* species, and 1 of the 3 *Oncaea* species appeared at the surface.

STATION 32

October 5, 1928; 15° 18' N, 68° 11' W; bottom depth, 4566 m; 54 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	28.0	27.2	22.2	Density (σ_{tP})	23.1	23.5	25.6
Salinity, o/oo	35.9	35.9	36.3	Hydrogen-ion conc. (pH)	8.23	8.24	8.15
<i>Acartia longiremis</i>.....	..	..	c	<i>Haloptilus ornatus</i>.....	..	..	c
<i>Aetideus armatus</i>.....	..	..	r	<i>Labidocera wollastoni</i>	r	..	..
<i>Calanopia americana</i>.....	..	..	r	<i>Lucicutia flavicornis</i>.....	..	..	c
<i>elliptica</i>	r	..	..	<i>Macrosetella gracilis</i>	f	f	c
<i>Calanus helgolandicus</i>.....	..	..	c	<i>Mecynocera clausi</i>.....	..	..	r
<i>minor</i>	f	a	f	<i>Microcalanus pusillus</i>.....	..	f	..
<i>propinquus</i>.....	..	..	r	<i>Microsetella norvegica</i>	f	f	c
<i>Calocalanus pavo</i>.....	..	..	r	<i>Oithona plumifera</i>	r	..	..
<i>Candacia bispinosa</i>.....	..	r	r	<i>similis</i>.....	..	f	c
<i>norvegica</i>	r	..	..	<i>spinirostris</i>.....	..	..	f
<i>pachydactyla</i>.....	..	r	r	<i>Oithonina nana</i>.....	..	f	..
<i>Centropages furcatus</i>	f	..	r	<i>Oncaea conifera</i>	2	..	..
<i>hamatus</i>	f	..	..	<i>media</i>	r	..	..
<i>Clausocalanus arcuicornis</i>	r	..	..	<i>minuta</i>	c	f	f
<i>Clytemnestra scutellata</i>.....	..	r	..	<i>subtilis</i>.....	..	r	..
<i>Copilia denticulata</i>	r	..	..	<i>venusta</i>	c	a	a
<i>Corycaeus anglicus</i>	f	..	..	<i>Paracalanus parvus</i>	c	a	a
<i>crassiusculus</i>.....	..	..	f	<i>Phaenna spinifera</i>.....	..	..	f
<i>dubius</i>	r	..	..	<i>Pontella atlantica</i>	r	..	..
<i>furcifer</i>.....	..	r	..	<i>lobiancoi</i>	r	..	..
<i>lautus</i>.....	..	2	..	<i>Pontellina plumata</i>	r	..	..
<i>minimus</i>.....	..	..	r	<i>Pseudocalanus minutus</i>	f	a	c
<i>speciosus</i>	f	a	a	<i>Rhincalanus nasutus</i>	c	..	c
<i>Eucalanus elongatus</i>.....	..	c	f	<i>Scolecithrix danae</i>.....	..	r	c
<i>Euchaeta marina</i>	c	a	c	<i>Temora longicornis</i>	r	f	r
<i>Farranula carinata</i>	c	f	f	<i>stylifera</i>	f	f	a
<i>rostrata</i>	c	f	f	<i>Undinula vulgaris</i>.....	..	..	r

A high temperature at the surface and at 50 meters, with a drop of more than 5° at 100 meters; the salinity and hydrogen-ion concentration varying very little. Twenty-nine species were found at the surface, 24 at 50 meters, and 34 at 100 meters. Thirteen species were found at all three depths, and

34 (63 per cent) were each present in but one tow. The surface tow contained the only Atlantic record of *Calanopia elliptica*, and the 50-meter tow the only Atlantic record of *Corycaeus furcifer*. *Corycaeus*, *Farranula*, and *Oncaea* were each well represented in the surface tow, with only one *Oithona* species.

STATION 33

October 8, 1928; 13° 37' N, 76° 22' W; bottom depth, 4039 m; 27 species

Depth of tow, m	50	100	Depth of tow, m	50	100
Temperature, °C	28.1	22.3	Density (σ_{1P})	23.4	25.7
Salinity, o/oo	36.2	36.4	Hydrogen-ion concentration (pH)	8.24	8.18

Calanus helgolandicus	r	..	Mecynocera clausi	r	..
minor	..	r	Microsetella norvegica	f	c
propinquus	..	r	rosea	..	r
Candacia bispinosa	r	..	Oithona plumifera	r	r
Corycaeus crassiusculus	f	..	similis	r	..
speciosus	..	f	Oncaea minuta	f	..
Eucalanus elongatus	r	..	venusta	c	c
Euchaeta marina	f	r	Paracalanus parvus	r	..
Farranula carinata	r	f	Pseudocalanus minutus	f	..
gibbula	f	..	Rhincalanus nasutus	..	r
rostrata	..	f	Temora longicornis	a	c
Lubbockia squillimana	..	r	stylifera	f	r
Lucicutia flavicornis	..	a	Undinula vulgaris	..	r
Macrosetella gracilis	r	c			

Vessel rolling and pitching badly, occasioning loss of surface tow. Eighteen species were found in the 50-meter tow and 17

in the 100-meter tow; 8 species were found at both depths, and 19 (70 per cent) were each present in but one tow.

STATION 34

October 9, 1928; 11° 18' N, 78° 34' W; bottom depth, 3536 m; 48 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	28.5	24.9	20.5	Density (σ_{tP})	22.9	24.7	26.3
Salinity, o/oo	35.8	36.5	36.6	Hydrogen-ion conc. (pH)	8.28	8.21	8.16

<i>Acartia clausii</i>.....	..	r	f	<i>Megacalanus longicornis</i>.....	..	r	f
<i>Aetideus armatus</i>.....	..	..	r	<i>Microsetella norvegica</i>	c	f	f
<i>Calanus helgolandicus</i>.....	..	..	r	<i>rosea</i>.....	..	r	f
<i>minor</i>.....	..	c	f	<i>Oithona plumifera</i>	c	c	f
<i>Calocalanus pavo</i>.....	..	f	..	<i>similis</i>.....	..	c	a
<i>Candacia bispinosa</i>.....	..	r	r	<i>spinirostris</i>.....	..	r	f
<i>norvegica</i>.....	..	r	..	<i>Oithonina nana</i>.....	..	r	..
<i>Clausocalanus arcuicornis</i>.....	..	f	c	<i>Oncaea minuta</i>	r	r	r
<i>Clytemnestra scutellata</i>.....	..	r	..	<i>tenella</i>	r	..	..
<i>Copilia denticulata</i>.....	..	r	..	<i>venusta</i>	a	c	a
<i>Corycaeus agilis</i>	f	r	..	<i>Paracalanus parvus</i>.....	..	r	f
<i>crassiusculus</i>	f	c	c	<i>Phaenna spinifera</i>.....	..	c	c
<i>speciosus</i>	c	r	f	<i>Pontella securifer</i>	r	..	..
<i>Eucalanus elongatus</i>.....	..	f	f	<i>Pontellina plumata</i>.....	..	r	..
<i>Euchaeta marina</i>.....	..	a	a	<i>Pseudocalanus minutus</i>	f	f	..
<i>Farranula carinata</i>	c	r	f	<i>Rhincalanus cornutus</i>.....	..	c	f
<i>gibbula</i>	f	..	..	<i>nasutus</i>.....	..	c	c
<i>rostrata</i>	c	f	f	<i>Sapphirina angusta</i>.....	..	..	r
<i>Haloptilus ornatus</i>.....	..	r	f	<i>scarlata</i>.....	..	r	..
<i>Lubbockia squillimana</i>.....	..	..	r	<i>Scolecithrix danae</i>.....	..	c	a
<i>Lucicutia flavicornis</i>.....	..	c	..	<i>Spinocalanus abyssalis</i>.....	..	..	r
<i>Macrosetella gracilis</i>	r	c	f	<i>Temora longicornis</i>	r	r	r
<i>oculata</i>.....	..	r	r	<i>stylifera</i>	c	r	r
<i>Mecynocera clausi</i>.....	..	f	r	<i>Undinula vulgaris</i>.....	..	c	c

The temperature, high at the surface, dropped 4° at 50 meters and 4° more at 100 meters; the salinity increased and the hydrogen-ion concentration diminished downward, each by small amounts. Sixteen species were found at the surface, 40 at 50 meters, and 35 at 100 meters. Eleven species were found at all three depths, and 16 (33 per cent) were each

present in but one tow. The surface tow contained the only Atlantic record of *Pontella securifer* and the 50-meter tow the only Atlantic record of *Sapphirina scarlata*. All the species of *Corycaeus*, *Farranula*, and *Oncaea* were well represented at the surface, but only one of the three *Oithona* species appeared there.

STATION 35

October 26, 1928; 6° 32' N, 80° 04' W; bottom depth, 3583 m; 96 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.4	16.8	14.4	Density (σ_{tP})	18.6	25.6	26.5
Salinity, o/oo	29.7	34.7	34.9	Hydrogen-ion conc. (pH)	8.31	7.92	7.88
Volume of tow, cm ³	80	112	96	Length of tow, miles	0.7	0.8	0.8

Acartia danae	..	2	4	Haloptilus spiniceps	..	..	2
negligens	..	2	..	Heterorhabdus papilliger	..	4	3
Acrocalanus gibber	4	..	..	Heterostylites longicornis	..	..	1
gracilis	f	f	f	Lubbockia aculeata	..	a	c
longicornis	r	f	..	squillimana	..	3	..
Aegisthus spinulosus	..	..	c	Lucicutia clausii	..	5	f
Aetideus armatus	..	4	f	flavicornis	..	r	f
Amalothrix arcuata	..	..	3 ♀	Macrosetella gracilis	..	2	..
Augaptilus longicaudatus	..	..	1 ♀	oculata	1	..	..
Calanus minor	f	f	r	Mecynocera clausi	..	c	f
Calocalanus pavo	f	2	1	Microcalanus pusillus	2	c	c
plumulosus	..	2	..	pygmaeus	..	f	c
Candacia bispinosa	..	..	1	Microsetella rosea	2	f	c
simplex	1	1	1	Neocalanus gracilis	..	f	r
truncata	..	1	3	robustior	..	1	..
Canthocalanus pauper	2	4	4	Oithona attenuata	..	3	..
Centropages calaninus	1	..	1	brevicornis	..	..	2
Clausocalanus arcuicornis	f	f	f	similis	..	f	c
furcatus	..	1	..	spinirostris	..	f	c
Clytemnestra rostrata	..	2	..	Oithonina nana	..	2	..
Conaea gracilis	..	f	2	Oncaea anglica	..	2 ♀	..
Corycaeus anglicus	..	..	2	conifera	..	2	r
catus	..	..	4	curta	r	a	c
crassiusculus	r	..	..	curvata	..	..	r
flaccus	r	..	f	media	a	a	a
giesbrechti	2	..	..	minuta	a	a	a
lautus	..	2	3	similis	f	f	c
limbatus	r	r	1	subtilis	2	..	..
lubbockii	..	..	2	venusta	f	a	a
pacificus	2	..	..	Paracalanus parvus	c	f	c
pumilus	2	..	f	pygmaeus	..	2	..
speciosus	..	..	2	Phaenna spinifera	..	4	r
Eucalanus attenuatus	..	f	f	Pleuromamma abdominalis	..	..	2
elongatus	..	3	f	gracilis	..	..	r
monachus	..	3	f	Pontellina plumata	r	2	..
mucronatus	..	2	..	Pseudocalanus minutus	f	c	c
Euchaeta acuta	..	..	4	Rhincalanus cornutus	..	..	f
hebes	..	..	3	nasutus	..	1	5
marina	..	f	f	Sapphirina auronitens	5	..	..
Euchirella rostrata	..	1	..	nigromaculata	..	..	1
Farranula carinata	a	5	r	Scolecithricella abyssalis	..	..	r
concinna	c	4	f	bradyi	..	1	3
curta	r	..	2	Scolecithrix danae	..	1	3
gibbula	1	1	3	Temora discaudata	5	..	..
rostrata	a	..	..	longicornis	3	..	..
Gaetanus armiger	..	..	1	Temoropia mayumbaensis	..	..	3
Haloptilus acutifrons	..	..	4	Undinula darwini	..	..	1
longicornis	..	..	5	Vettopia granulosa	..	5	f

This is the first station in the Pacific Ocean after passing through the Panama Canal, and also the first of a long series of stations, 35 to 80, all of which are considerably influenced by the complicated network of surface currents that prevail

in this part of the Pacific. The stations from 35 to 42 are in that part of the Counter Equatorial Current which turns south on nearing the west coast of Costa Rica and crosses the equator, swinging back to the west and joining the

Southern Equatorial Current (map 2). Under the influence of this current the surface waters of the region maintain a high temperature and a low salinity, with the hydrogen-ion concentration slightly alkaline. That these conditions are favorable to the copepods is seen in the exceptionally large number of species found at these stations (see p. 5). At station 35 there were 35 species in the surface tow, 58 in the 50-meter tow, and 71 in the 100-meter tow. Forty-seven species (49 per cent) were each confined to a single depth and 19 were present at all three depths, an exceptionally large number. If the designations of relative abundance in this station record are examined, it will be found that half of them are numerals, which indicates that although the three tows yielded a large number of species, at least half of them were represented by

very few individuals. Again we find the smaller species the more numerous, those of *Corycaeus*, *Farranula*, *Oithona*, *Oncaea*, and *Paracalanus* totaling 31 species, nearly all of which are well represented. The 100-meter tow contains the only record of *Euchaeta hebes* and *Amallothrix arcuata*, and this and the 50-meter tow contain the only record of *Conaea gracilis*. The *Temoropia* species was described by T. Scott (1894, p. 79) from the Gulf of Guinea and reported by A. Scott (1909, p. 119) from several localities in the Pacific considerably farther west than the present station; it was also taken by the *Carnegie* at station 152. The scarcity of the *Candacia* species is also worthy of note, since five of the six records consisted of single specimens and the sixth record was of only 3 specimens.

BETWEEN STATIONS 35 AND 36 (a)
October 26, 1928; 6° 16' N, 80° 17' W; 65 species

<i>Acartia danae</i> c	<i>Corycaeus limbatus</i> f	<i>Oncaea curvata</i> r
<i>negligens</i> f	<i>pacificus</i> 3	<i>media</i> a
<i>Acrocalanus gibber</i> f	<i>pumilus</i> f	<i>minuta</i> a
<i>gracilis</i> c	<i>Eucalanus attenuatus</i> 1	<i>notopa</i> r
<i>Aegisthus spinulosus</i> c	<i>crassus</i> r	<i>similis</i> f
<i>Calanus minor</i> a	<i>monachus</i> f	<i>subtilis</i> r
<i>Calocalanus pavo</i> c	<i>Euchaeta acuta</i> 4	<i>venusta</i> a
<i>plumulosus</i> 2	<i>marina</i> 2	<i>Pandarus sinuatus</i> , juv..... 1 ♀
<i>Candacia simplex</i> f	<i>Farranula carinata</i> a	<i>Paracalanus parvus</i> c
<i>truncata</i> f	<i>concinna</i> f	<i>Pontella danae</i> 1
<i>Canthocalanus pauper</i> f	<i>gibbula</i> a	<i>Pontellina plumata</i> a
<i>Centropages calaninus</i> 2	<i>gracilis</i> 2	<i>Pseudocalanus minutus</i> c
<i>furcatus</i> c	<i>rostrata</i> c	<i>Sapphirina auronitens</i> 3
<i>Clausocalanus arcuicornis</i> f	<i>Labidocera acuta</i> 4	<i>Scolecithricella bradyi</i> 2
<i>Clytemnestra scutellata</i> 2	<i>detruncata</i> 5	<i>Scolecithrix danae</i> 2
<i>Copilia denticulata</i> 1	<i>Macrosetella gracilis</i> c	<i>Temora discaudata</i> f
<i>Corycaeus agilis</i> f	<i>Microcalanus pygmaeus</i> f	<i>stylifera</i> f
<i>andrewsi</i> c	<i>Microsetella rosea</i> r	<i>Undinula caroli</i> 2
<i>clausi</i> r	<i>Neocalanus gracilis</i> 1	<i>darwinii</i> 1
<i>crassiusculus</i> f	<i>Oithona brevicornis</i> 2	<i>vulgaris</i> f
<i>dubius</i> f	<i>plumifera</i> f	<i>Vetтория granulosa</i> 2
<i>flaccus</i> 2	<i>similis</i> f	

Volume of tow, 128 cm³; time, 7^h10^m to 10^h50^m P.M.; length, 2.2 miles; surface only. This is the first of a series of four night tows, three at the surface and one at 50 meters, taken when the vessel was becalmed between stations 35 and 36. It yielded 65 species of copepods, making it the largest surface tow for the entire cruise. The present tow contains 11 species not found in the other three, and lacks 36 species that were

found in one or more of those three, a fact which emphasizes the diversity of surface distribution. It contains the only record for *Pandarus sinuatus*, a species parasitic on sharks and rays; a single young female was taken while swimming freely in the tow. The record shows only two species of *Candacia* but contains a long series of *Corycaeus* and *Oncaea*, three of the latter being especially abundant.

BETWEEN STATIONS 35 AND 36 (b)
 October 27, 1928; 5° 22' N, 79° 59' W; 64 species

<i>Acartia danae</i> c	<i>Corycaeus agilis</i> f	<i>Macrosetella gracilis</i> c
<i>negligens</i> c	<i>catus</i> 2	<i>Microcalanus pusillus</i> 4
<i>Acrocalanus gibber</i> c	<i>clausi</i> r	<i>pygmaeus</i> f
<i>gracilis</i> c	<i>crassiusculus</i> f	<i>Microsetella norvegica</i> 1
<i>longicornis</i> f	<i>flaccus</i> f	<i>rosea</i> r
<i>Aegisthus spinulosus</i> 1	<i>giesbrechti</i> 3	<i>Neocalanus gracilis</i> 4
<i>Calanus minor</i> a	<i>lautus</i> 5	<i>Oithona similis</i> 3
<i>propinquus</i> f	<i>limbatus</i> f	<i>Oithonina nana</i> 2
<i>Calocalanus pavo</i> c	<i>pacificus</i> 4	<i>Oncaea curta</i> f
<i>plumulosus</i> 2	<i>pumilus</i> c	<i>media</i> c
<i>Candacia bipinnata</i> 2	<i>speciosus</i> c	<i>minuta</i> a
<i>bispinosa</i> 3	<i>Eucalanus elongatus</i> 2	<i>similis</i> f
<i>curta</i> 1	<i>monachus</i> c	<i>subtilis</i> f
<i>norvegica</i> 1	<i>Euchaeta marina</i> r	<i>venusta</i> a
<i>pachydactyla</i> 2	<i>Farranula carinata</i> a	<i>Paracalanus parvus</i> r
<i>simplex</i> f	<i>concinna</i> f	<i>Pontellina plumata</i> a
<i>Canthocalanus pauper</i> f	<i>gibbula</i> c	<i>Pseudocalanus minutus</i> f
<i>Centropages calaninus</i> 1	<i>rostrata</i> a	<i>Scolecithricella marginata</i> 1 ♀
<i>furcatus</i> a	<i>Labidocera acuta</i> 2	<i>Temora discaudata</i> f
<i>Clausocalanus arcuicornis</i> f	<i>detruncata</i> c	<i>Undinula caroli</i> 2
<i>furcatus</i> 2	<i>Lucicutia clausii</i> 2	<i>vulgaris</i> f
<i>Clytemnestra rostrata</i> 1		

Volume of tow, 150 cm³; time, 7^h30^m to 9^h20^m P.M.; length, 0.6 mile; surface only. This is the second of the nocturnal surface tows, and contains 64 species, only 1 less than the preceding tow. Thirteen of these species were not present in either of the other tows, and conversely those tows contained 28 species which are not found here, again emphasizing

diversity. Here at the surface in the night appeared 6 species of *Candacia*, 3 of which were not found at any depth in the daytime at either station 35 or 36, and again there are long series of *Corycaeus* and *Oncaea*. *Centropages furcatus* and *Pontellina plumata* were exceptionally abundant in this tow, their normal representation being only a few individuals.

BETWEEN STATIONS 35 AND 36 (c)
 October 28, 1928; 4° 16' N, 79° 37'–47' W; 72 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Volume of tow, cm ³	160	48	Length of tow, miles	1.0	3.2
<i>Acartia danae</i>.....	..	c	<i>Farranula curta</i>.....	..	c
<i>negligens</i>	f	..	<i>gibbula</i>	a	f
<i>Acrocalanus gibber</i>.....	..	2	<i>rostrata</i>	2	..
<i>gracilis</i>	f	f	<i>Gaetanus minor, juv.</i>.....	..	1♂
<i>longicornis</i>	2	f	<i>Labidocera acuta</i>	4	..
<i>Aegisthus spinulosus</i>.....	..	c	<i>detruncata</i>	a	2
<i>Calanus minor</i>	a	c	<i>Lubbockia squillimana</i>.....	..	1
<i>Calocalanus pavo</i>	c	c	<i>Macrosetella gracilis</i>	r	f
<i>plumulosus</i>.....	..	2	<i>Mecynocera clausi</i>.....	..	c
<i>Candacia bispinosa</i>	1	4	<i>Microcalanus pusillus</i>	f	c
<i>pachydactyla</i>	5	..	<i>pygmaeus</i>	f	..
<i>simplex</i>	f	4	<i>Microsetella rosea</i>	f	r
<i>truncata</i>	r	5	<i>Neocalanus gracilis</i>.....	..	f
<i>Canthocalanus pauper</i>	c	3	<i>robustior</i>.....	..	1
<i>Centropages calaninus</i>	2	..	<i>Oithona attenuata</i>.....	..	4
<i>furcatus</i>	f	a	<i>brevicornis</i>.....	..	3
<i>violaceus</i>.....	..	2	<i>plumifera</i>.....	..	f
<i>Clausocalanus arcuicornis</i>.....	..	c	<i>similis</i>	f	c
<i>furcatus</i>	c	f	<i>spinirostris</i>.....	..	c
<i>Clytemnestra scutellata</i>.....	..	2	<i>Oncaea curta</i>	c	a
<i>Copilia quadrata</i>.....	..	2	<i>media</i>	a	..
<i>Corycaeus agilis</i>	f	1	<i>minuta</i>	a	a
<i>clausi</i>	r	..	<i>subtilis</i>	4	..
<i>crassiusculus</i>.....	..	1	<i>venusta</i>	c	a
<i>dubius</i>	r	..	<i>Paracalanus aculeatus</i>.....	..	1
<i>lautus</i>.....	..	3	<i>parvus</i>	c	c
<i>limbatus</i>.....	..	f	<i>pygmaeus</i>	f	..
<i>pumilus</i>.....	..	3	<i>Pleuromamma gracilis</i>	5	..
<i>Eucalanus attenuatus</i>.....	..	r	<i>Pontellina plumata</i>	c	..
<i>crassus</i>.....	..	r	<i>Pseudocalanus minutus</i>	f	c
<i>elongatus</i>	f	f	<i>Rhincalanus cornutus</i>.....	..	5
<i>monachus</i>.....	..	f	<i>Sapphirina angusta</i>.....	..	1
<i>Euchaeta acuta</i>	f	..	<i>ovatolanceolata</i>.....	..	2
<i>marina</i>	c	r	<i>Temora discaudata</i>	f	f
<i>Farranula carinata</i>	a	a	<i>stylifera</i>.....	..	4
<i>concinna</i>.....	..	a	<i>Undinula vulgaris</i>	c	f

This record includes the third of the nocturnal surface tows and an additional 50-meter tow; time, 9^h40^m P.M. to 12^h50^m A.M. The former contains only 2 species not found in the other surface tows, but it does not contain 50 species that were found in them, thereby even surpassing them in diversity. Forty-one species were found in the surface tow and 58

in the 50-meter tow; 27 species were present in both tows, and 45 were each confined to a single tow. Nocturnal tows at lower levels yield interesting comparisons with surface hauls. The volume of the 1-mile surface tow is three and one-third times that of the 3-mile 50-meter tow, and yet the latter contained 17 more copepod species than the former.

STATION 36

October 30, 1928; 2° 54' N, 80° 02' W; bottom depth, 4880 m; 75 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	26.5	18.5	14.4	Density (σ_{tP})	20.3	25.0	26.4
Salinity, o/oo	31.6	34.5	34.9	Hydrogen-ion conc. (pH)	8.23	8.03	7.85
Volume of tow, cm ³	198	86	32	Length of tow, miles	0.5	0.8	0.8

<i>Acartia negligens</i>	r	..	1	<i>Haloptilus longicornis</i> . . . . .	..	..	2
<i>Acrocalanus gibber</i>	f	..	..	<i>ornatus</i> . . . . .	..	..	1♂
<i>gracilis</i>	f	f	f	<i>plumosus</i> . . . . .	..	..	1
<i>monachus</i> . . . . .	..	..	1	<i>Heterorhabdus papilliger</i> . . . . .	..	..	1
<i>Aetideus armatus</i> . . . . .	..	1	..	<i>Labidocera detruncata</i>	c	..	..
<i>Amalothrix obtusifrons</i> . . . . .	..	1	..	<i>Lubbockia aculeata</i> . . . . .	..	r	..
<i>Calanus minor</i>	a	f	f	<i>Lucicutia clausii</i> . . . . .	..	1	1
<i>Calocalanus pavo</i>	c	..	1	<i>flavicornis</i> . . . . .	..	4	f
<i>Candacia simplex</i>	f	..	4	<i>Macrosetella gracilis</i>	4	..	..
<i>truncata</i> . . . . .	..	..	2	<i>Microcalanus pusillus</i> . . . . .	..	..	2
<i>Canthocalanus pauper</i>	c	..	2	<i>pygmaeus</i>	f	..	2
<i>Centropages calaninus</i>	3	..	1	<i>Microsetella rosea</i>	2	f	f
<i>furcatus</i>	c	4	r	<i>Neocalanus gracilis</i>	1	2	..
<i>Clausocalanus arcuicornis</i>	f	f	r	<i>tenuicornis</i> . . . . .	..	1	..
<i>furcatus</i>	c	f	c	<i>Oithona attenuata</i> . . . . .	..	1	..
<i>Copilia denticulata</i>	4	1	..	<i>plumifera</i>	4	3	4
<i>Corycaeus agilis</i>	f	..	1	<i>similis</i>	c	f	..
<i>andrewsi</i>	c	..	2	<i>spinirostris</i> . . . . .	..	2	2
<i>crassiusculus</i>	5	..	..	<i>Oncaea anglica</i> . . . . .	..	..	1♀
<i>dubius</i> . . . . .	..	2	2	<i>curvata</i> . . . . .	..	2	..
<i>lautus</i>	3	..	..	<i>media</i>	a	a	..
<i>limbatus</i>	f	..	..	<i>mediterranea</i> . . . . .	..	..	4
<i>pumilus</i>	5	..	..	<i>minuta</i>	a	a	a
<i>robustus</i>	2	..	1	<i>similis</i> . . . . .	..	f	4
<i>speciosus</i>	f	3	1	<i>venusta</i>	a	a	a
<i>Euaetideus giesbrechti</i> . . . . .	..	..	5	<i>Paracalanus parvus</i>	c	f	f
<i>Eucalanus crassus</i> . . . . .	..	1	..	<i>Pseudocalanus minutus</i> . . . . .	..	f	..
<i>elongatus</i>	4	3	4	<i>Rhincalanus cornutus</i> . . . . .	..	5	..
<i>monachus</i>	f	2	f	<i>nasutus</i> . . . . .	..	4	3
<i>Euchaeta acuta</i> . . . . .	..	..	2	<i>Sapphirina auronitens</i>	4	..	..
<i>marina</i>	f	f	f	<i>Scolecithricella bradyi</i> . . . . .	..	1	..
<i>Euchirella intermedia</i> . . . . .	..	..	1	<i>Scolecithrix danae</i>	2	..	..
<i>pulchra</i> . . . . .	..	..	1♂	<i>Temora discaudata</i>	f	..	5
<i>Farranula carinata</i>	a	f	c	<i>stylifera</i>	1	..	..
<i>gibbula</i>	a	1	c	<i>Undinula caroli</i>	3	1	..
<i>gracilis</i>	3	..	2	<i>darwinii</i> . . . . .	..	..	f
<i>rostrata</i>	f	..	..	<i>vulgaris</i>	r	..	..
<i>Haloptilus acutifrons</i> . . . . .	..	..	2				

Forty-four species were present at the surface, 37 in the 50-meter tow, and 49 in the 100-meter tow. The surface tow of 0.5 mile yielded more than six times the volume of plankton that was obtained in the 100-meter tow of 0.8 mile, but the

latter contained 5 more copepod species than the former. The three tows totaled 75 species, of which 38 (51 per cent) were each confined to a single depth, and 15 were found at all three depths.

STATION 37

November 1, 1928; 5° 59' N, 82° 56' W; bottom depth, 3324 m; 88 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.1	19.8	15.1	Density (σ_t)	20.2	24.7	26.3
Salinity, o/oo	31.6	34.5	34.9	Hydrogen-ion conc. (pH)	8.28	8.00	7.82
Volume of tow, cm ³	224	32	64	Length of tow, miles	0.8	1.0	1.0
<i>Acartia danae</i>.....	..	2	3	<i>Labidocera detruncata</i>	a	..	..
<i>negligens</i>	f	..	2	<i>Lubbockia aculeata</i>.....	..	4	f
<i>Acrocalanus gibber</i>	f	..	..	<i>squillimana</i>.....	..	..	1
<i>gracilis</i>	c	f	f	<i>Lucicutia bicornuta</i>.....	..	1	..
<i>longicornis</i>	f	1	..	<i>clausii</i>.....	..	1	f
<i>Aetideus armatus</i>.....	..	..	4	<i>flavicornis</i>.....	..	..	f
<i>Calanus minor</i>	c	c	c	<i>Mecynocera clausi</i>.....	..	1	r
<i>Calocalanus pavo</i>	c	..	f	<i>Microcalanus pusillus</i>.....	..	f	f
<i>Candacia bispinosa</i>	2	..	..	<i>pygmaeus</i>	r	f	f
<i>pachydactyla</i>	4	..	..	<i>Microsetella rosea</i>.....	..	2	f
<i>simplex</i>	c	..	..	<i>Miracia efferata</i>	3	..	..
<i>Canthocalanus pauper</i>	c	f	..	<i>Neocalanus gracilis</i>.....	..	f	..
<i>Centropages calaninus</i>	2	2	..	<i>tenuicornis</i>.....	..	2	..
<i>furcatus</i>.....	..	1	2	<i>Oithona attenuata</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>	f	..	..	<i>plumifera</i>	1	f	f
<i>furcatus</i>	a	c	a	<i>similis</i>	4	..	..
<i>Clytemnestra scutellata</i>.....	..	..	1	<i>spinostris</i>.....	..	5	f
<i>Copilia denticulata</i>	3	1	..	<i>vivida</i>.....	..	1 ♀	2 ♀
<i>Corycaeus agilis</i>	f	..	..	<i>Oithonina nana</i>.....	..	..	2
<i>andrewsi</i>	4	..	..	<i>Oncaea curta</i>.....	..	2	4
<i>crassiusculus</i>	4	..	..	<i>curvata</i>.....	..	..	2
<i>dubius</i>	c	2	..	<i>media</i>	c	c	c
<i>lautus</i>	2	..	2	<i>minuta</i>	a	a	a
<i>limbatus</i>	4	..	1	<i>similis</i>.....	..	f	..
<i>pacificus</i>	2	r	..	<i>subtilis</i>.....	..	r	2
<i>pumilus</i>	f	2	..	<i>venusta</i>	a	a	a
<i>robustus</i>	2	..	..	<i>Paracalanus parvus</i>	c	c	f
<i>speciosus</i>	f	..	..	<i>pygmaeus</i>.....	..	r	4
<i>typicus</i>	f	..	..	<i>Phaenna spinifera</i>.....	..	2	f
<i>Danodes plumata</i> , n. gen. and n. sp.	3 ♀	..	..	<i>Pleuromamma gracilis</i>.....	..	..	5
<i>Euaetideus giesbrechti</i>.....	..	..	3	<i>Pontella lobiancoi</i>	1	..	..
<i>Eucalanus crassus</i>.....	..	..	2	<i>Pontellina plumata</i>	a	..	f
<i>elongatus</i>.....	..	f	..	<i>Pseudocalanus minutus</i>	f	2	f
<i>monachus</i>	3	c	f	<i>Rhincalanus cornutus</i>.....	..	..	1
<i>mucronatus</i>.....	..	..	f	<i>Sapphirina auronitens</i>	5	..	..
<i>Euchaeta acuta</i>	2	..	5	<i>nigromaculata</i>.....	..	..	2
<i>marina</i>	f	f	4	<i>Scolecithricella abyssalis</i>.....	..	..	r
<i>Farranula carinata</i>	a	a	c	<i>bradyi</i>	1	2	4
<i>gibbula</i>	a	c	c	<i>minor</i>.....	..	..	1
<i>gracilis</i>	f	..	f	<i>Scolecithrix danae</i>.....	..	2	2
<i>rostrata</i>	f	..	..	<i>Temora discaudata</i>	f	..	..
<i>Gaetanus miles</i>.....	..	..	1	<i>Undinula darwinii</i>.....	..	4	..
<i>Haloptilus longicornis</i>.....	..	..	4	<i>vulgaris</i>	2	..	..
<i>Heterorhabdus papilliger</i>.....	..	..	3	<i>Vettopia granulosa</i>.....	..	..	4

The temperature dropped 44 per cent in the upper 100 meters; the salinity rose 3 points and the density 6 points. Forty-nine species were taken at the surface, 42 in the 50-meter tow, and 55 in the 100-meter tow, but the volume of the surface tow was seven times that of the 50-meter tow and three and a half times that of the 100-meter tow although its length was 20 per cent less than that of either of the others. Forty-four species (50 per cent) were each confined to a

single tow, and 15 were found in all three tows. The 3 specimens of *Oithona vivida* taken in the two deeper tows are the only ones obtained during the cruise. Numerals are less frequent in the abundance records, but there are still 6 species each of which is represented by a single specimen. *Corycaeus*, *Oithona*, and *Oncaea* were each well represented by species in all three tows, and the surface tow contained 3 specimens of the new genus *Danodes*.

STATION 38

November 3, 1928; 3° 46' N, 81° 37' W; bottom depth, 2264 m; 86 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	26.4	21.3	15.6	Density (σ_{tP})	21.3	24.1	26.2
Salinity, o/oo	32.8	34.3	34.9	Hydrogen-ion conc. (pH)	8.33	8.14	7.91
Volume of tow, cm ³	48	70	150	Length of tow, miles	0.8	2.5	2.5

<i>Acartia danae</i>.....	..	c	c	<i>Haloptilus plumosus</i>.....	..	..	1
<i>negligens</i>.....	..	f	..	<i>Labidocera detruncata</i>	1	..	..
<i>Acrocalanus gracilis</i>.....	..	f	2	<i>Lubbockia aculeata</i>.....	..	..	f
<i>longicornis</i>.....	..	..	1	<i>squillimana</i>.....	..	1	1
<i>Aetideus armatus</i>.....	..	..	4	<i>Lucicutia clausii</i>.....	..	1	..
<i>Calanus minor</i>	c	..	c	<i>flavicornis</i>.....	..	c	c
<i>tonsus</i>.....	..	..	1	<i>longicornis</i>.....	..	..	1
<i>Calocalanus pavo</i>	f	f	f	<i>Macrosetella gracilis</i>.....	..	..	1
<i>plumulosus</i>	1	..	..	<i>Mecynocera clausi</i>.....	..	2	..
<i>Candacia bispinosa</i>.....	..	..	1	<i>Megacalanus longicornis</i>.....	..	1	..
<i>simplex</i>.....	..	5	..	<i>princeps</i>.....	..	..	3
<i>truncata</i>.....	..	..	2	<i>Microcalanus pygmaeus</i>.....	..	3	r
<i>Canthocalanus pauper</i>	f	..	f	<i>Microsetella rosea</i>.....	..	..	c
<i>Centropages furcatus</i>.....	..	c	f	<i>Neocalanus gracilis</i>.....	..	..	2
<i>Clausocalanus arcuicornis</i>.....	..	..	f	<i>robustior</i>.....	..	1	..
<i>furcatus</i>	a	c	a	<i>Oithona attenuata</i>.....	..	2	3
<i>Clytemnestra scutellata</i>.....	..	..	1	<i>plumifera</i>.....	..	4	..
<i>Copilia denticulata</i>	1	2	2	<i>similis</i>.....	..	c	..
<i>Corycaeus agilis</i>	f	..	3	<i>spinostris</i>.....	..	..	r
<i>crassiusculus</i>.....	..	..	3	<i>Oncaea conifera</i>.....	..	..	c
<i>dubius</i>	3	..	2	<i>curta</i>.....	..	..	2
<i>flaccus</i>.....	..	2	2	<i>media</i>.....	..	c	a
<i>lautus</i>	3	..	2	<i>minuta</i>	a	c	a
<i>limbatus</i>.....	..	..	2	<i>similis</i>.....	..	..	2
<i>pumilus</i>	4	..	2	<i>venusta</i>	a	a	a
<i>speciosus</i>	2	5	..	<i>Paracalanus parvus</i>	c	c	c
<i>Danodes plumata</i> , n. gen. and n. sp.	1 ♀	..	..	<i>pygmaeus</i>	f	..	..
<i>Euaetideus bradyi</i>.....	..	..	1	<i>Phaenna spinifera</i>.....	..	..	c
<i>giesbrechti</i>.....	..	..	3	<i>Pontellina plumata</i>	2	..	2
<i>Eucalanus attenuatus</i>.....	..	f	f	<i>Pseudocalanus minutus</i>	c	f	f
<i>crassus</i>.....	..	f	3	<i>Rhincalanus cornutus</i>.....	..	1	4
<i>elongatus</i>.....	..	f	5	<i>nasutus</i>.....	..	..	4
<i>monachus</i>.....	..	c	a	<i>Sapphirina nigromaculata</i>.....	..	2	1
<i>mucronatus</i>	f	..	2	<i>Scolecithricella abyssalis</i>.....	..	..	2
<i>Euchaeta acuta</i>.....	..	2	4	<i>bradyi</i>.....	..	4	2
<i>marina</i>	2	f	f	<i>minor</i>.....	..	..	1
<i>Euchirella brevis</i>.....	..	2	..	<i>Scolecithrix danae</i>.....	..	..	r
<i>pulchra</i>.....	..	..	5	<i>Spinocalanus abyssalis</i>.....	..	..	2
<i>Farranula carinata</i>	a	f	a	<i>Temora discaudata</i>	f	..	2
<i>curta</i>.....	..	2	2	<i>Undinula caroli</i>.....	..	..	r
<i>gibbula</i>	a	f	c	<i>darwinii</i>.....	..	3	f
<i>gracilis</i>.....	..	..	3	<i>vulgaris</i>	4	r	f
<i>Haloptilus longicornis</i>.....	..	..	1	<i>Vettopia granulosa</i>.....	..	..	4

The drop in temperature here was 40 per cent, the rise in salinity 2 points, and the rise in density 5 points. The 50-meter tow, with a length three times that of the surface tow, had a volume only one-half larger, and yielded half as many more species. The 100-meter tow had twice the volume of the 50-meter tow, with the same length, and yielded almost twice as many species. There were 25 species at the surface, 40 in the 50-meter tow, and 72 in the 100-meter tow. Forty-six

species (53 per cent) were each confined to a single tow and 11 were present in all three tows. The 1 *Aetideus* and 2 *Euaetideus* species were restricted to the 100-meter tow; the 3 *Candacia* species, 4 of the 5 *Eucalanus* species, the 4 *Oithona* species, and the 2 *Rhincalanus* species appeared only in the two deeper tows. *Corycaeus* and *Oncaea* were well represented with species which were divided among all three tows. One specimen of the new genus *Danodes* was taken at the surface.

STATION 39

November 6, 1928; 0° 52' N, 81° 14' W; bottom depth, 3200 m; 85 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	24.8	16.3	14.0	Density (σ_t)	21.8	25.6	26.6
Salinity, o/oo	32.9	34.6	34.9	Hydrogen-ion conc. (pH)	8.24	7.92	7.88
Volume of tow, cm ³	336	48	38	Length of tow, miles	1.1	1.1	1.1
<i>Acartia negligens</i>.....	..	..	f	<i>Heterorhabdus papilliger</i>.....	..	2	..
<i>Acrocalanus gibber</i>	r	..	r	<i>spinifrons</i>.....	..	1	..
<i>gracilis</i>	f	..	3	<i>Lucicutia clausii</i>.....	..	..	1
<i>monachus</i>	1	..	..	<i>flavicornis</i>.....	..	3	c
<i>Aegisthus spinulosus</i>.....	..	1	3	<i>longicornis</i>.....	..	..	2
<i>Aetideus armatus</i>.....	..	..	f	<i>Macrosetella gracilis</i>.....	..	..	1
<i>Amalothrix obtusifrons</i>.....	..	..	2	<i>Microcalanus pusillus</i>	f	f	c
<i>Calanus minor</i>	a	..	c	<i>pygmaeus</i>	f	f	f
<i>Calocalanus pavo</i>	f	..	c	<i>Microsetella rosea</i>	2	r	..
<i>Candacia bispinosa</i>.....	..	1	..	<i>Miracia efferata</i>	4	r	..
<i>curta</i>.....	..	..	2	<i>Neocalanus gracilis</i>	2	..	4
<i>pachydaetyla</i>.....	..	..	1	<i>robustior</i>.....	..	..	1
<i>simplex</i>.....	..	3	..	<i>Oithona attenuata</i>.....	..	..	2
<i>truncata</i>.....	..	1	..	<i>plumifera</i>.....	..	1	4
<i>Canthocalanus pauper</i>	a	c	c	<i>similis</i>.....	..	..	f
<i>Centropages furcatus</i>	1	3	4	<i>spinirostris</i>.....	..	2	r
<i>Clausocalanus arcuicornis</i>	4	r	f	<i>Oncaea conifera</i>.....	..	c	c
<i>furcatus</i>	a	a	a	<i>curta</i>.....	..	2	f
<i>Clytemnestra rostrata</i>.....	..	..	1	<i>media</i>	c	c	a
<i>scutellata</i>.....	..	..	2	<i>minuta</i>	a	..	a
<i>Corycaeus agilis</i>	4	f	..	<i>similis</i>.....	..	..	2
<i>andrewsi</i>.....	..	..	1	<i>subtilis</i>.....	..	..	1
<i>crassiusculus</i>	2	..	4	<i>venusta</i>	a	a	a
<i>lautus</i>	1	..	..	<i>Pachyptilus abbreviatus</i> , juv.....	..	1♂	..
<i>limbatus</i>	1	..	..	<i>Paracalanus parvus</i>	c	..	f
<i>speciosus</i>.....	..	..	4	<i>pygmaeus</i>	4	..	r
<i>Euaetideus bradyi</i>.....	..	..	2	<i>Phaenna spinifera</i>.....	..	..	f
<i>giesbrechti</i>.....	..	..	2	<i>Pseudocalanus minutus</i>.....	..	..	f
<i>Eucalanus attenuatus</i>	2	..	2	<i>Rhincalanus cornutus</i>.....	..	..	f
<i>crassus</i>.....	..	f	..	<i>nasutus</i>.....	..	3	f
<i>elongatus</i>.....	..	2	f	<i>Sapphirina auronitens</i>	3	3	..
<i>monachus</i>	c	c	c	<i>nigromaculata</i>	1	2	..
<i>mucronatus</i>.....	..	c	..	<i>Scolecithricella abyssalis</i>.....	..	1	..
<i>Euchaeta acuta</i>.....	..	r	f	<i>bradyi</i>.....	..	..	2
<i>marina</i>	1	f	c	<i>marginata</i>.....	..	1	..
<i>Euchirella brevis</i>.....	..	1	..	<i>minor</i> , juv.....	1♂	..	..
<i>rostrata</i>.....	..	..	1	<i>Scolecithrix danae</i>.....	..	..	2
<i>Farranula carinata</i>	2	f	f	<i>Temora discaudata</i>	c	c	f
<i>curta</i>.....	..	..	1	<i>stylifera</i>	1	..	..
<i>gibbula</i>	c	f	c	<i>Undinula darwinii</i>	f	f	2
<i>gracilis</i>	2	..	..	<i>vulgaris</i>	3	3	..
<i>Haloptilus longicornis</i>.....	..	..	f	<i>Vettopia granulosa</i>.....	..	1	..
<i>ornatus</i>.....	..	..	1				

There was a drop in temperature of 43 per cent between the surface and the 100-meter level, a rise of 2 points in salinity, and a slight diminution in hydrogen-ion concentration. The frequent numerals in the abundance records still indicate a very small number of specimens for many of the species. *Candacia*, *Corycaeus*, *Eucalanus*, and *Oncaea* were each represented by 5 to 7 species, although the number of individuals in all except *Oncaea* was very small. The 50-meter tow con-

tained the only record for *Pachyptilus abbreviatus*, a young male not fully developed. Forty-five species (53 per cent) were each confined to a single depth and 14 were taken at all three depths. More specimens of *Lucicutia longicornis* were captured here in the 100-meter tow than at any other locality. The 1 *Aetideus*, 2 *Euaetideus*, and 2 *Rhincalanus* species were found only in the deepest tow, and the 5 *Candacia* species were confined to the two deeper tows.

STATION 40

November 8, 1928; 1° 32' S, 82° 16' W; bottom depth, 1344 m; 90 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	22.2	15.3	13.9	Density (σ_{tP})	23.2	26.0	26.6
Salinity, o/oo	33.7	34.9	34.9	Hydrogen-ion conc. (pH)	8.21	7.87	7.85
Volume of tow, cm ³	288	70	62	Length of tow, miles	1.2	1.0	1.0

<i>Acartia negligens</i>	3	1	..	<i>Farranula rostrata</i>	2	..	..
<i>Acrocalanus gibber</i>	f	..	3	<i>Haloptilus longicornis</i>.....	..	..	4
<i>gracilis</i>	f	2	f	<i>ornatus</i>.....	..	..	1 ♀
<i>longicornis</i>	3	..	..	<i>Heterorhabdus papilliger</i>.....	..	1	..
<i>Aegisthus spinulosus</i>	1	..	..	<i>Heterostylites longicornis</i>.....	..	1	3
<i>Aetideus armatus</i>.....	..	2	2	<i>Labidocera acuta</i>	f	..	..
<i>Amalothrix obtusifrons</i>.....	..	1 ♀	..	<i>detruncata</i>	f	..	..
<i>Calanus minor</i>	c	c	c	<i>Lucicutia clausii</i>.....	..	..	1
<i>tonsus</i>.....	..	2	..	<i>flavicornis</i>.....	..	1	4
<i>Calocalanus pavo</i>	f	..	3	<i>Macrosetella gracilis</i>.....	..	1	..
<i>stylemisis</i>	1 ♀	..	..	<i>Microcalanus pusillus</i>	f	c	f
<i>Candacia bispinosa</i>	1	..	..	<i>pygmaeus</i>	f	c	f
<i>curta</i>	2	..	5	<i>Microsetella rosea</i>	f	f	f
<i>pachydaetyla</i>.....	..	1	5	<i>Miracia efferata</i>.....	..	2	1
<i>Canthocalanus pauper</i>	a	a	r	<i>Neocalanus gracilis</i>.....	..	4	..
<i>Centropages furcatus</i>	f	2	2	<i>Oithona brevicornis</i>	3	..	..
<i>Clausocalanus arcuicornis</i>	f	2	3	<i>plumifera</i>	f	f	c
<i>furcatus</i>	c	c	c	<i>similis</i>	f	c	c
<i>Clytemnestra scutellata</i>.....	..	2	..	<i>spirostris</i>	1	3	f
<i>Copilia denticulata</i>.....	..	..	1	<i>Oithonina nana</i>.....	..	..	2
<i>Corycaeus agilis</i>	f	..	..	<i>Oncaea conifera</i>	2	5	c
<i>andrewsi</i>	f	3	..	<i>curta</i>	3	f	5
<i>crassiusculus</i>	c	c	f	<i>curvata</i>	2	4	..
<i>dubius</i>	f	..	2	<i>media</i>.....	..	c	c
<i>limbatus</i>	4	..	2	<i>minuta</i>	a	c	a
<i>ovalis</i>	2	..	..	<i>venusta</i>	a	a	..
<i>pacificus</i>	2	..	2	<i>Onchocalanus nudipes</i> , n. sp.	2 ♀	..	..
<i>pumilus</i>	f	4	4	<i>Paracalanus parvus</i>	c	c	c
<i>robustus</i>	f	..	..	<i>pygmaeus</i>.....	..	..	4
<i>speciosus</i>	f	4	..	<i>Pareuchaeta tumidula</i>.....	..	1 ♀	..
<i>Euaetideus giesbrechti</i>.....	..	..	1	<i>Phaenna spinifera</i>.....	..	c	f
<i>Eucalanus elongatus</i>	f	..	..	<i>Pontella danae</i>	2	..	..
<i>monachus</i>	c	f	f	<i>Pontellina plumata</i>	c	..	..
<i>mucronatus</i>.....	..	f	..	<i>Pontellopsis lubbockii</i>	f	..	..
<i>subtenuis</i>.....	..	..	1 ♂	<i>regalis</i> , juv.	2	..	..
<i>Euchaeta acuta</i>	c	a	a	<i>Pseudocalanus minutus</i>.....	..	f	f
<i>marina</i>	c	c	..	<i>Rhincalanus cornutus</i>.....	..	2	..
<i>Euchirella brevis</i>.....	..	..	1 ♀	<i>nasutus</i>.....	..	a	a
<i>curticauda</i>.....	..	1	1	<i>Sapphirina auronitens</i>	2	2	1
<i>pulchra</i>.....	..	2	..	<i>opalina</i>.....	..	1	..
<i>rostrata</i>.....	..	3	..	<i>Scolecithricella bradyi</i>	1	2	4
<i>Farranula carinata</i>	a	..	r	<i>Scolecithrix danae</i>.....	..	2	4
<i>curta</i>	1	..	..	<i>Temora discaudata</i>	a	..	2
<i>gibbula</i>	a	c	f	<i>Undinula darwinii</i>	f	f	f
<i>gracilis</i>	4	..	..	<i>vulgaris</i>	f	4	..

The drop in temperature was almost 40 per cent in the 100 meters, the rise in salinity was only 1 point, and the hydrogen-ion concentration diminished a little. The volume of the tow at the surface was four times that at each of the two greater depths, with only a 20 per cent increase in its length. The number of species in this surface tow was also a little larger than in either of the other tows, which is the reverse of the usual proportion. Forty species (44 per cent) were each con-

finned to a single depth and 24 were found at all three depths. The species are exceptionally well distributed vertically, with 58 at the surface, 51 at 50 meters, and 55 at 100 meters. About half of the abundance records are for 5 individuals or less, 24 of them being single specimens. The surface tow contains the only record for *Pontellopsis lubbockii*, the 50-meter tow the only record for *Pareuchaeta tumidula*, and the 100-meter tow one of the few records for *Eucalanus subtenuis*.

STATION 41

November 10, 1928; 1° 37' S, 86° 58' W; bottom depth, 2568 m; 74 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	20.4	14.6	14.5	Density (σ_{tP})	24.0	26.3	26.5
Salinity, o/oo	34.1	35.0	35.0	Hydrogen-ion conc. (pH)	8.11	7.94	7.92
Volume of tow, cm ³	224	54	86	Length of tow, miles	2.0	1.7	1.7

<i>Acartia danae</i>.....	..	c	c	<i>Lucicutia clausii</i>.....	..	..	2
<i>Acrocalanus gibber</i>	2	..	..	<i>flavicornis</i>.....	..	..	3
<i>gracilis</i>	f	..	..	<i>longicornis</i>.....	..	..	2
<i>longicornis</i>.....	..	..	f	<i>Microcalanus pusillus</i>	f	..	..
<i>Aegisthus spinulosus</i>	a	..	..	<i>pygmaeus</i>	f	1	..
<i>Calanus tonsus</i>.....	..	f	..	<i>Microsetella rosea</i>.....	..	2	c
<i>Calocalanus pavo</i>	1	..	..	<i>Neocalanus gracilis</i>.....	..	..	f
<i>styliremis</i>	1	..	..	<i>tenuicornis</i>.....	..	..	2
<i>Canthocalanus pauper</i>.....	..	f	..	<i>Oithona attenuata</i>	2	3	r
<i>Centropages furcatus</i>	2	c	f	<i>plumifera</i>	f	2	..
<i>Clausocalanus arcuicornis</i>	c	f	..	<i>similis</i>	1	a	a
<i>furcatus</i>	f	..	..	<i>spinirostris</i>.....	..	..	a
<i>Clytemnestra scutellata</i>.....	..	1	..	<i>Oncaea conifera</i>.....	..	..	c
<i>Corycaeus agilis</i>.....	..	2	r	<i>curta</i>.....	..	2	3
<i>crassiusculus</i>	4	1	f	<i>media</i>	r	f	r
<i>pumilus</i>	2	..	..	<i>minuta</i>	f	..	a
<i>speciosus</i>	f	..	..	<i>subtilis</i>.....	..	..	4
<i>typicus</i>.....	..	..	r	<i>tenella</i>.....	..	..	2
<i>Eucalanus attenuatus</i>.....	..	r	..	<i>venusta</i>	f	c	c
<i>crassus</i>.....	..	f	f	<i>Paracalanus parvus</i>	c	c	f
<i>elongatus</i>.....	..	f	f	<i>Phaenna spinifera</i>.....	..	..	1
<i>monachus</i>	2	f	c	<i>Pleuromamma gracilis</i>.....	..	..	r
<i>mucronatus</i>.....	..	f	f	<i>Pontella danae</i>	1	..	..
<i>Euchaeta acuta</i>.....	..	..	2	<i>Pontellina plumata</i>	1	..	..
<i>marina</i>	f	r	r	<i>Pseudocalanus minutus</i>	f	f	r
<i>Euterpina acutifrons</i>.....	..	1	2	<i>Rhincalanus cornutus</i>	1	c	r
<i>Farranula carinata</i>	f	..	..	<i>nasutus</i>	3	f	a
<i>curta</i>	f	..	..	<i>Sapphirina auronitens</i>	1	..	..
<i>gibbula</i>	4	..	..	<i>opalina</i>.....	..	3	..
<i>gracilis</i>	2	..	..	<i>Scolecithricella bradyi</i>.....	..	2	..
<i>Gaidius tenuispinus</i>.....	..	1 ♀	..	<i>Scolecithrix danae</i>.....	..	1	..
<i>Haloptilus longicornis</i>.....	..	..	f	<i>Spinocalanus abyssalis</i>.....	..	4	..
<i>ornatus</i>.....	..	..	2	<i>Temora discaudata</i>	4	..	1
<i>Heterorhabdus papilliger</i>.....	..	..	3	<i>longicornis</i>.....	..	..	1 ♂
<i>Labidocera acuta</i>	1	..	..	<i>Undinula caroli</i>.....	..	2 ♀	..
<i>detruncata, juv.</i>	2	..	..	<i>darwinii</i>	2	f	r
<i>Lubbockia squillimana</i>.....	..	..	5	<i>Vettopia granulosa</i>.....	..	..	1

The temperature dropped 6° in the 100 meters, the salinity rose 1 point, and the hydrogen-ion concentration diminished a little. The volume of the surface tow was four times that of the 50-meter tow and two and a half times that of the 100-meter tow, although its length was only one-sixth greater. Forty-seven species (63 per cent) were each confined to a single depth and 12 were present at all three depths. *Corycaeus*, *Eucalanus*, and *Oncaea* were each again represented by 5 to 7 species, but *Candacia* was entirely absent. The vertical distribution was 36 species at the surface, 34 in the 50-meter tow, and 44 in the 100-meter tow. Both *Rhincalanus* species were present at all three depths, instead of being confined to the deeper tows as usual. Three of the *Farranula* species appeared only in the surface tow, and 1 species was equally divided between the surface and the 100-meter tow. Sim-

ilarly, 2 of the *Acrocalanus* species were confined to the surface tow and the third species was confined to the 100-meter tow. Of the *Corycaeus* species, 1 appeared only in the two deeper tows, 1 appeared at all three depths, 2 were confined to the surface tow, and 1 to the 100-meter tow. Similar differences can be found among the *Oithona* and *Oncaea* species.

A careful study of any of these station records where a large number of species of the same genus are present supports the suggestion of Rose (see p. 13) that the adaptation of copepods to light varies with each species. It will also go far toward removing opposition to his further suggestion that possibly such adaptation varies with each individual. The inconsistencies which so frequently confront us can hardly be explained on any other assumption.

BETWEEN STATIONS 41 AND 42

November 12, 1928; 1° 12' S, 91° 27' W; 19 species

<i>Calanus propinquus</i>	3	<i>Farranula gracilis</i>	f	<i>Oithona similis</i>	f
<i>Corycaeus agilis</i>	2	<i>rostrata</i>	c	<i>Oncaea venusta</i>	f
<i>catus</i>	1	<i>Labidocera acuta</i>	3	<i>Paracalanus parvus</i>	a
<i>pumilus</i>	r	<i>Microsetella rosea</i>	r	<i>Pseudocalanus minutus</i>	r
<i>typicus</i>	r	<i>Miracia efferata</i>	2	<i>Undinula darwinii</i>	2
<i>Eucalanus crassus</i>	2	<i>Neocalanus gracilis</i>	r	<i>vulgaris</i>	f
<i>Farranula gibbula</i>	1				

This nocturnal surface tow was less productive than those between stations 35 and 36, and yielded only 19 species, half of which were represented by 3 specimens or less. *Calanus propinquus* was not present at station 41 and only in the 100-

meter tow at station 42. Two of the *Corycaeus* species, *agilis* and *typicus*, were confined to the deeper tows at stations 41 and 42, and *catus* did not appear at either of those stations; nor did *Miracia efferata* and *Undinula vulgaris*.

STATION 42

November 13, 1928; 1° 32' S, 93° 10' W; bottom depth, 3539 m; 74 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	18.7	17.2	13.8	Density (σ_{tP})	24.8	25.6	26.7
Salinity, o/oo	34.7	34.9	35.0	Hydrogen-ion conc. (pH)	8.06	7.99	7.92
Volume of tow, cm ³	32	134	64	Length of tow, miles	0.7	0.3	0.5
<i>Acartia danae</i>.....	..	c	r	<i>Heterostylites longicornis</i>.....	..	..	r
<i>negligens</i>.....	..	3	..	<i>Lubbockia squillimana</i>.....	..	f	5
<i>Acrocalanus gracilis</i>	r	..	..	<i>Lucicutia clausii</i>.....	..	3	f
<i>Actideus armatus</i>.....	..	2	f	<i>flavicornis</i>.....	..	..	f
<i>Arietellus setosus</i>.....	..	..	f	<i>Macrosetella oculata</i>.....	..	1	..
<i>Augaptilus longicaudatus</i>.....	..	..	1 ♀	<i>Mecynocera clausi</i>.....	..	1	..
<i>Calanus minor</i>.....	..	f	..	<i>Microcalanus pygmaeus</i>.....	..	2	1
<i>propinquus</i>.....	..	..	2	<i>Microsetella rosea</i>	r	c	r
<i>Calocalanus pavo</i>.....	..	2	3	<i>Neocalanus gracilis</i>.....	..	4	r
<i>styliremis</i>.....	..	r	1 ♂	<i>robustior</i>.....	..	..	1
<i>Canthocalanus pauper</i>	f	..	2	<i>Oithona attenuata</i>.....	..	r	..
<i>Centropages calaninus</i>.....	..	..	1	<i>plumifera</i>.....	..	..	2
<i>furcatus</i>.....	..	..	1	<i>similis</i>	c	a	a
<i>Clausocalanus arcuicornis</i>.....	..	r	..	<i>spinirostris</i>.....	..	2	c
<i>furcatus</i>	1	..	..	<i>Oithonina nana</i>	1	3	..
<i>Corycaeus agilis</i>.....	..	a	a	<i>Oncaea conifera</i>.....	..	f	..
<i>crassiusculus</i>.....	..	c	..	<i>curta</i>.....	..	f	r
<i>dubius</i>.....	..	f	..	<i>curvata</i>.....	..	r	r
<i>ovalis</i>.....	..	f	..	<i>media</i>.....	..	c	a
<i>pumilus</i>	1	..	..	<i>minuta</i>	c	a	a
<i>speciosus</i>.....	..	r	..	<i>similis</i>	2	r	..
<i>typicus</i>.....	..	f	..	<i>subtilis</i>.....	..	r	..
<i>Danodes plumata</i> , n. gen. and n. sp.	2 ♀	..	..	<i>tenella</i>.....	..	f	r
<i>Eucalanus attenuatus</i>.....	..	..	r	<i>venusta</i>.....	..	a	c
<i>crassus</i>.....	..	..	r	<i>Paracalanus aculeatus</i>	1	..	..
<i>elongatus</i>.....	..	f	f	<i>parvus</i>	a	a	a
<i>monachus</i>.....	..	f	f	<i>Phaenna spinifera</i>.....	..	2	..
<i>Euchaeta acuta</i>.....	..	..	3	<i>Pleuromamma gracilis</i>.....	..	..	f
<i>marina</i>	2	4	r	<i>Pseudocalanus minutus</i>	f	c	c
<i>Farranula curta</i>	1	r	..	<i>Rhincalanus nasutus</i>.....	..	f	c
<i>gibbula</i>	2	f	a	<i>Sapphirina auronitens</i>.....	..	1	..
<i>gracilis</i>	f	a	a	<i>Scolecithricella bradyi</i>.....	..	1	..
<i>rostrata</i>	c	..	..	<i>Scolecithrix danae</i>.....	..	r	..
<i>Haloptilus longicornis</i>.....	..	..	1	<i>Spinocalanus abyssalis</i>	3	3	..
<i>plumosus</i>.....	..	..	1	<i>Undinula caroli</i>.....	..	1	..
<i>spiniceps</i>.....	..	..	1	<i>darwinii</i>.....	..	r	..
<i>Heterorhabdus papilliger</i>.....	..	..	f	<i>Vetтория granulosa</i>.....	..	2	..

The temperature fell 5° in the 100 meters; the salinity and hydrogen-ion concentration changed very little. The 50-meter tow was four times the volume of the surface tow although less than half as long, and it was twice the volume of the 100-meter tow, but only three-fifths as long. Hence, as would be expected, the species were erratically distributed at the three depths, 19 at the surface, 50 at 50 meters, and 44 at 100 meters. Forty-three species (60 per cent) were each confined to a single depth and 7 were found at all three depths.

Corycaeus, *Eucalanus*, and *Oncaea* were again well represented in species, especially in the two deeper tows, but *Candacia* was entirely absent. The 100-meter tow has the only record for *Arietellus setosus* and one of the few for *Augaptilus longicaudatus*. *Haloptilus*, *Heterorhabdus*, and *Heterostylites* were confined to the 100-meter tow. Although *Paracalanus parvus* was recorded as abundant at all three depths, the actual number of specimens was much larger in the 50-meter tow than in either of the others.

STATION 43

November 15, 1928; 2° 30' S, 95° 43' W; bottom depth, 3352 m; 71 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	19.5	17.0	13.5	Density (σ_{tP})	24.7	25.7	26.7
Salinity, o/oo	34.8	34.9	35.0	Hydrogen-ion conc. (pH)	8.09	7.93	7.90
Volume of tow, cm ³	176	32	32	Length of tow, miles	1.8	1.2	1.2
<i>Acartia danae</i>.....	..	c	..	<i>Megacalanus longicornis</i>.....	..	..	1
<i>negligens</i>.....	..	2	..	<i>Microcalanus pygmaeus</i>.....	..	4	3
<i>Acrocalanus gibber</i>	c	r	..	<i>Microsetella rosea</i>.....	..	r	f
<i>gracilis</i>	c	r	f	<i>Neocalanus gracilis</i>.....	..	f	2
<i>Calanus minor</i>.....	..	c	c	<i>robustior</i>.....	..	f	4
<i>propinquus</i>.....	..	1	..	<i>tenuicornis</i>.....	..	..	1 ♀
<i>Canthocalanus pauper</i>	1 ♂	..	..	<i>Oithona attenuata</i>.....	..	r	..
<i>Centropages violaceus</i>.....	..	1	..	<i>plumifera</i>.....	..	r	r
<i>Clausocalanus arcuicornis</i>	a	f	f	<i>similis</i>	a	a	a
<i>furcatus</i>	a	c	f	<i>spinirostris</i>.....	..	r	f
<i>Corycaeus agilis</i>	f	a	c	<i>Oithonina nana</i>.....	..	..	4
<i>andrewsi</i>.....	..	a	a	<i>Oncaea conifera</i>.....	..	..	1
<i>catus</i>.....	..	..	1	<i>curta</i>	f	f	f
<i>crassiusculus</i>.....	..	f	..	<i>media</i>	c	f	c
<i>dubius</i>.....	..	2	..	<i>mediterranea</i>	r	r	..
<i>flaccus</i>.....	..	f	..	<i>minuta</i>	a	a	a
<i>speciosus</i>.....	..	3	..	<i>notopa</i>	f	..	..
<i>typicus</i>	r	r	1	<i>similis</i>.....	..	a	f
<i>Danodes plumata</i> , n. gen. and n. sp.	2 ♀	..	..	<i>subtilis</i>	f	f	f
<i>Eucalanus attenuatus</i>.....	..	r	..	<i>tenella</i>	f	f	..
<i>crassus</i>.....	..	r	..	<i>venusta</i>	c	a	a
<i>elongatus</i>.....	..	r	2	<i>Paracalanus parvus</i>	a	c	c
<i>monachus</i>.....	..	c	c	<i>pygmaeus</i>.....	..	..	3
<i>mucronatus</i>.....	..	r	..	<i>Phaenna spinifera</i>.....	..	4	..
<i>subtenuis</i>.....	..	1 ♂	..	<i>Pleuromamma gracilis</i>.....	..	..	1 ♀
<i>Euchaeta acuta</i>.....	..	3	f	<i>Pontella danae</i>	f	..	..
<i>marina</i>	2	f	f	<i>Pontellina plumata</i>	f	..	1
<i>Euchirella pulchra</i>.....	..	..	1 ♂	<i>Pontellopsis regalis</i>	f	..	..
<i>Farranula gibbula</i>.....	..	2	..	<i>Pseudocalanus minutus</i>	a	f	c
<i>gracilis</i>	r	2	2	<i>Sapphirina auronitens</i>.....	..	r	r
<i>rostrata</i>.....	..	2	..	<i>nigromaculata</i>.....	..	..	4
<i>Haloptilus longicornis</i>.....	..	..	1	<i>Scolecithricella bradyi</i>.....	..	f	1
<i>Labidocera detruncata</i>	f	..	..	<i>Spinocalanus abyssalis</i>.....	..	f	1
<i>Lubbockia squillimana</i>.....	..	..	1	<i>Undinula caroli</i>.....	..	f	..
<i>Lucicutia clausii</i>.....	..	3	1	<i>darwinii</i>.....	..	f	f
<i>Mecynocera clausi</i>.....	..	r	..				

The temperature fell 6° in the 100 meters; the salinity and hydrogen-ion concentration changed but little. The surface tow was 50 per cent longer than either of the others and its volume was five times as great. Twenty-five species were taken at the surface, 53 in the 50-meter tow, and 44 in the 100-meter tow. Almost exactly half the species were each confined to a single level, and 14 were present at all three levels. *Corycaeus*, *Eucalanus*, and *Oncaea* were more numerous in

species and more abundant in individuals than at the preceding station. The two former were especially evident in the 50-meter tow, the latter in all three tows. *Paracalanus* was much less abundant than at station 42, especially in the two deeper tows. Two specimens of the new genus *Danodes* were taken in the surface tow, but it is apparently nowhere abundant. Of the 25 species taken at the surface, those of *Clausocalanus*, *Paracalanus*, and *Pseudocalanus* were abundant.

STATION 44

November 17, 1928; 3° 15' S, 99° 48' W; bottom depth, 3423 m; 89 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	20.6	20.4	13.7	Density ($\sigma_{t,p}$)	24.4	24.7	26.7
Salinity, o/oo	34.8	34.8	35.0	Hydrogen-ion conc. (pH)	8.03	8.04	7.86
Volume of tow, cm ³	246	80	192	Length of tow, miles	1.3	1.3	1.3

<i>Acartia danae</i>	c	c	a	<i>Heterorhabdus papilliger</i>.....	..	2	2
<i>longiremis</i>	1	..	..	<i>spinifrons</i>.....	..	..	1
<i>negligens</i>	c	f	2	<i>Heterostylites longicornis</i>.....	..	..	1
<i>Acrocalanus gracilis</i>	f	f	r	<i>Labidocera detruncata</i>	f	..	..
<i>Aetideus armatus</i>.....	..	..	c	<i>nerii</i>	f	..	..
<i>Amalothrix obtusifrons</i>.....	..	4	..	<i>Lubbockia squillimana</i>.....	..	r	3
<i>Calanus minor</i>.....	..	c	c	<i>Lucicutia clausii</i>	1	..	3
<i>tonsus</i>.....	..	..	2	<i>Macrosetella gracilis</i>	r	..	..
<i>Calocalanus pavo</i>	1	f	1♂	<i>oculata</i>.....	..	2	..
<i>styliremis</i>.....	..	f	..	<i>Mecynocera clausi</i>.....	..	2	..
<i>Candacia armata</i>	1	..	..	<i>Microcalanus pygmaeus</i>	f	f	..
<i>curta</i>.....	..	1	..	<i>Microsetella rosea</i>.....	..	f	c
<i>simplex</i>.....	..	1	..	<i>Neocalanus gracilis</i>.....	..	f	f
<i>truncata</i>.....	..	r	..	<i>robustior</i>.....	..	f	..
<i>Centropages calaninus</i>	1	..	1	<i>tenuicornis</i>.....	..	1	..
<i>Clausocalanus arcuicornis</i>	c	..	c	<i>Oithona attenuata</i>.....	..	f	f
<i>furcatus</i>	c	..	f	<i>plumifera</i>.....	..	r	..
<i>Copilia denticulata</i>.....	..	2	1♂	<i>similis</i>	c	a	c
<i>Corycaeus agilis</i>	f	c	f	<i>spinirostris</i>	f	c	a
<i>andrewsi</i>	f	c	c	<i>Oncaea conifera</i>.....	..	..	f
<i>catus</i>	f	..	r	<i>curta</i>	f	f	f
<i>crassiusculus</i>	1	r	3	<i>media</i>	c	f	c
<i>flaccus</i>.....	..	f	..	<i>minuta</i>	a	a	..
<i>minimus</i>	1	..	..	<i>notopa</i>.....	..	..	r
<i>pacificus</i>.....	..	r	..	<i>similis</i>.....	..	r	f
<i>pumilus</i>	f	r	..	<i>subtilis</i>.....	..	..	r
<i>speciosus</i>.....	..	2	2	<i>venusta</i>.....	..	a	a
<i>typicus</i>	c	r	..	<i>Paracalanus parvus</i>	a	c	c
<i>Danodes plumata</i> , n. gen. and n. sp.	4♀	..	..	<i>Phaenna spinifera</i>.....	..	c	..
<i>Eucalanus attenuatus</i>.....	..	1	..	<i>Pontella danae</i>	1	..	..
<i>crassus</i>.....	..	..	r	<i>tenuiremis</i>	c	..	..
<i>elongatus</i>.....	..	f	f	<i>Pontellina plumata</i>	r	..	..
<i>monachus</i>.....	..	c	r	<i>Pontellopsis regalis</i>	2	..	..
<i>mucronatus</i>.....	..	f	..	<i>Pseudocalanus minutus</i>	f	f	c
<i>Euchaeta acuta</i>.....	..	..	3	<i>Sapphirina opalina</i>.....	..	..	1
<i>marina</i>.....	..	f	r	<i>Scolecithricella bradyi</i>.....	..	3	..
<i>Farranula curta</i>	r	..	..	<i>marginata</i>.....	..	4	..
<i>gibbula</i>	r	c	..	<i>Scolecithrix danae</i>	1	2	..
<i>gracilis</i>	a	..	f	<i>Spinocalanus abyssalis</i>.....	..	..	1
<i>rostrata</i>	a	..	r	<i>Temora stylifera</i>	1	..	..
<i>Gaidius tenuispinus</i>.....	..	1	..	<i>Undinula caroli</i>.....	..	a	..
<i>Haloptilus acutifrons</i>.....	..	..	1	<i>darwinii</i>.....	..	a	r
<i>longicornis</i>.....	..	..	4	<i>vulgaris</i>.....	..	a	..
<i>plumosus</i>.....	..	..	2	<i>Vettopia granulosa</i>.....	..	..	r
<i>spiniceps</i>.....	..	..	1				

The temperature dropped only 0°2 in the upper 50 meters, but fell nearly 7° in the next 50 meters. The salinity and hydrogen-ion concentration were fairly high and changed very little. All three tows were of the same length, but the volume of the surface tow was three times that of the 50-meter tow and 1.3 times that of the 100-meter tow. Forty-nine species (55 per cent) were each confined to a single depth and 13 were present at all three depths. Thirty-nine species were found at the surface, 53 in the 50-meter tow, and 50 in the 100-

meter tow. *Corycaeus* and *Oncaea* were rich in species, which were well distributed in all three tows. *Eucalanus* and *Oithona* had 4 or 5 species each, and all but 2 *Oithona* species were confined to the deeper tows. The 4 species of *Haloptilus* appeared only in the 100-meter tow, together with *Aetideus*, *Heterorhabdus spinifrons*, and *Spinocalanus*. The surface tow contained *Corycaeus minimus* and *Labidocera nerii*, which were found in only a few other localities. The 3 species of *Undinula* were abundant; 2 occurred only in the 50-meter tow.

STATION 45

November 19, 1928; 4° 35' S, 105° 03' W; bottom depth, 3342 m; 66 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	22.4	22.4	18.6	Density (σ_{tP})	24.1	24.3	24.8
Salinity, ‰	35.3	35.3	35.4	Hydrogen-ion conc. (pH)	8.12	8.13	8.11
Volume of tow, cm ³	118	80	118	Length of tow, miles	2.3	2.5	2.5

<i>Acartia danae</i>.....	..	a	a	<i>Labidocera detruncata</i>	f	..	..
<i>negligens</i>	f	f	f	<i>Lucicutia clausii</i>.....	..	..	1
<i>Acrocalanus gracilis</i>	2	r	2	<i>flavicornis</i>.....	..	..	1
<i>Calanus minor</i>.....	..	..	f	<i>Macrosetella gracilis</i>.....	..	1	3
<i>Calocalanus pavo</i>	2	f	f	<i>oculata</i>.....	..	..	2
<i>styliremis</i>.....	..	r	..	<i>Mecynocera clausi</i>	f	a	1
<i>Candacia pachyductyla</i>.....	..	1♂	..	<i>Microcalanus pygmaeus</i>.....	..	r	1
<i>simplex</i>.....	..	f	..	<i>Microsetella rosea</i>.....	..	r	a
<i>Clausocalanus arcuicornis</i>	r	f	..	<i>Neocalanus gracilis</i>.....	..	..	5
<i>furcatus</i>	a	..	f	<i>robustior</i>.....	..	..	1 ♀
<i>Clytemnestra rostrata</i>.....	..	1	..	<i>Oithona attenuata</i>	c	f	f
<i>Corycaeus agilis</i>	r	..	..	<i>brevicornis</i>	3	..	2
<i>catus</i>.....	..	f	4	<i>plumifera</i>.....	..	..	3
<i>crassiusculus</i>	r	f	2	<i>similis</i>	c	a	a
<i>dubius</i>	2	..	..	<i>spinirostris</i>.....	..	r	f
<i>limbatus</i>	r	r	..	<i>Oncaea conifera</i>.....	..	..	1
<i>pumilus</i>	4	..	..	<i>curta</i>.....	..	..	f
<i>robustus</i>	2	..	..	<i>media</i>	f	c	a
<i>speciosus</i>	r	f	..	<i>minuta</i>	c	a	c
<i>typicus</i>	1	..	1	<i>notopa</i>	3	..	3
<i>Eucalanus attenuatus</i>.....	..	r	..	<i>similis</i>	r	..	a
<i>elongatus</i>.....	..	f	f	<i>subtilis</i>.....	..	r	..
<i>monachus</i>.....	..	c	f	<i>tenella</i>.....	..	..	r
<i>subtenuis</i>.....	..	3	..	<i>venusta</i>	c	..	a
<i>Euchaeta marina</i>.....	..	..	1	<i>Paracalanus parvus</i>	a	..	f
<i>Euterpina acutifrons</i>.....	..	2	1	<i>Pontella princeps</i>	1	..	..
<i>Farranula curta</i>	f	a	3	<i>Pontellina plumata</i>	1	..	1
<i>gibbula</i>	c	..	f	<i>Pseudocalanus minutus</i>	c	f	f
<i>gracilis</i>	2	..	..	<i>Rhincalanus cornutus</i>.....	..	a	c
<i>rostrata</i>	a	c	..	<i>Scolecithrix danae</i>.....	..	..	1
<i>Haloptilus acutifrons</i>.....	..	..	1 ♀	<i>Temora stylifera</i>.....	..	2	..
<i>Heterorhabdus papilliger</i>.....	..	..	3	<i>Undinula caroli</i>.....	..	..	f
<i>Heterostylites longicornis</i>.....	..	..	1♂	<i>darwinii</i>.....	..	..	f

There was no change in temperature in the upper 50 meters, and only a 4° drop in the next 50 meters. The volumes of the surface and 100-meter tows were one-half larger than that of the 50-meter tow. Again just half of the species (50 per cent) were each confined to a single level; 11 were present at all three levels. The vertical distribution was 31 species at the surface, 33 at 50 meters, and 47 at 100 meters. This is the first appearance of *Pontella princeps*, which was found at a

few of these eastern Pacific stations and nowhere else. *Corycaeus*, *Farranula*, *Oithona*, and *Oncaea* were each represented by many species, well scattered through all three tows. *Candacia*, *Eucalanus*, *Haloptilus*, *Heterorhabdus*, *Lucicutia*, and *Rhincalanus* were each confined to the deeper tows and did not appear at the surface. The 100-meter tow showed an exceptionally high percentage of *Oncaea* and contained both species of *Acartia*.

STATION 46

November 21, 1928; 9° 06' S, 108° 20' W; bottom depth, 2905 m; 57 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	23.3	23.2	22.5	Density (σ_{tP})	24.1	24.3	24.8
Salinity, o/oo	35.3	35.3	35.4	Hydrogen-ion conc. (pH)	8.16	8.16	8.17
Volume of tow, cm ³	128	64	32	Length of tow, miles	1.8	1.8	1.8

<i>Acartia danae</i>	f	..	a	<i>Haloptilus longicornis</i>.....	..	..	5
<i>negligens</i>.....	..	c	r	<i>Labidocera detruncata</i>	c	1	..
<i>Acrocalanus gracilis</i>	4	r	r	<i>Lucicutia clausii</i>.....	..	..	f
<i>monachus</i>.....	..	3	..	<i>flavicornis</i>.....	..	..	3
<i>Calanus minor</i>.....	..	..	r	<i>Macrosetella gracilis</i>	2	r	r
<i>Calocalanus pavo</i>	2	2	..	<i>oculata</i>.....	..	..	1
<i>Candacia simplex</i>.....	..	f	r	<i>Mecynocera clausi</i>.....	..	f	r
<i>Centropages calaninus</i>.....	..	3	..	<i>Microcalanus pygmaeus</i>.....	..	1	3
<i>violaceus</i>.....	..	1 ♀	..	<i>Microsetella rosea</i>.....	..	f	f
<i>Clausocalanus furcatus</i>.....	..	2	c	<i>Neocalanus gracilis</i>.....	..	..	f
<i>Clytemnestra scutellata</i>.....	..	..	1	<i>Oithona attenuata</i>	2	c	c
<i>Corycaeus andrewsi</i>.....	..	..	1	<i>plumifera</i>.....	..	2	r
<i>catus</i>	r	f	3	<i>similis</i>.....	..	c	a
<i>crassiusculus</i>	3	f	f	<i>spinirostris</i>.....	..	1	f
<i>flaccus</i>.....	..	..	1	<i>Oncaea conifera</i>.....	..	..	2
<i>limbatus</i>	3	f	f	<i>media</i>.....	..	c	c
<i>ovalis</i>.....	..	2	4	<i>minuta</i>.....	..	a	c
<i>pacificus</i>.....	..	2	..	<i>notopa</i>.....	..	2	..
<i>pumilus</i>	r	f	3	<i>similis</i>.....	..	..	r
<i>robustus</i>	2	..	..	<i>tenella</i>.....	..	..	4
<i>speciosus</i>.....	..	f	f	<i>venusta</i>.....	..	..	r
<i>typicus</i>	1	4	c	<i>Paracalanus parvus</i>.....	..	c	c
<i>Eucalanus monachus</i>.....	..	r	r	<i>Pontella atlantica</i>	r	..	..
<i>Euterpina acutifrons</i>	1	4	..	<i>princeps</i>	c	..	..
<i>Farranula carinata</i>	a	c	a	<i>Pseudocalanus gracilis</i>	2 ♀	..	..
<i>curta</i>.....	..	f	c	<i>minutus</i>.....	..	f	c
<i>gibbula</i>	a	f	f	<i>Rhincalanus cornutus</i>.....	..	a	a
<i>gracilis</i>	c	c	..	<i>Undinula darwinii</i>.....	..	c	f
<i>rostrata</i>	a	a	a				

There was less than 1° of difference in temperature throughout the upper 100 meters, and practically no difference in salinity and hydrogen-ion concentration. The three tows were also of exactly the same length, yet the surface tow had twice the volume of the 50-meter tow and four times the volume of the 100-meter tow. Twenty-two species (40 per cent) each were confined to a single level and 11 were present at all three levels. In vertical distribution, 20 species were found at the

surface, 39 at the 50-meter level, and 44 at the 100-meter level. *Corycaeus* and *Oncaea* continued to be represented by many species, but *Candacia* and *Eucalanus* were each reduced to a single species. Curiously enough, whereas the *Corycaeus* species were as well distributed through all three tows as before, not a specimen of any *Oncaea* species appeared at the surface, and only 1 of the 4 species of *Oithona*. The surface tow contains the only record for *Pseudocalanus gracilis*.

STATION 47

November 23, 1928; 14° 07' S, 111° 50' W; bottom depth, 3080 m; 53 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	23.8	23.8	22.7	Density (σ_{tP})	24.4	24.7	25.3
Salinity, ‰	35.9	35.9	36.1	Hydrogen-ion conc. (pH)	8.23	8.23	8.23
Volume of tow, cm ³	144	38	32	Length of tow, miles	1.1	1.1	1.1

<i>Acartia danae</i>.....	..	c	..	<i>Haloptilus longicornis</i>.....	..	f	a
<i>negligens</i>	r	3	..	<i>Labidocera detruncata</i>	a	..	..
<i>Acrocalanus gracilis</i>	r	..	..	<i>Mecynocera clausi</i>.....	..	c	r
<i>Calocalanus pavo</i>	r	f	1	<i>Microcalanus pygmaeus</i>	3	..	..
<i>plumulosus</i>.....	..	1	..	<i>Microsetella norvegica</i>.....	..	r	..
<i>styliremis</i>.....	..	r	..	<i>rosea</i>	f	f	f
<i>Candacia simplex</i>	3	r	..	<i>Neocalanus gracilis</i>.....	..	..	c
<i>Centropages calaninus</i>.....	..	1	..	<i>Oithona attenuata</i>	c	c	r
<i>Clausocalanus arcuicornis</i>	f	..	..	<i>similis</i>.....	..	a	a
<i>furcatus</i>	a	..	2	<i>spinirostris</i>.....	..	a	f
<i>Clytemnestra scutellata</i>.....	..	2	..	<i>Oncaea curta</i>.....	..	f	..
<i>Corycaeus agilis</i>.....	..	..	2	<i>minuta</i>.....	..	a	a
<i>flaccus</i>.....	..	1	..	<i>notopa</i>.....	..	..	2
<i>lautus</i>	1	..	..	<i>similis</i>.....	..	..	r
<i>limbatus</i>	f	f	1	<i>tenella</i>.....	..	2	..
<i>longistylis</i>	2	1	..	<i>Paracalanus parvus</i>	a	f	f
<i>pumilus</i>.....	..	..	1	<i>pygmaeus</i>	c	..	..
<i>speciosus</i>.....	..	f	..	<i>Pontella danae</i>	1	..	..
<i>typicus</i>.....	..	f	r	<i>securifer</i>	1	..	..
<i>Eucalanus monachus</i>.....	..	3	..	<i>Pseudocalanus minutus</i>	c	2	..
<i>Euchirella brevis</i>.....	..	1	..	<i>Rhincalanus cornutus</i>.....	..	a	f
<i>Farranula carinata</i>	c	a	c	<i>Sapphirina auronitens</i>.....	..	..	1
<i>concinna</i>	2	c	f	<i>nigromaculata</i>	2	..	..
<i>curta</i>.....	..	f	..	<i>Temora discaudata</i>	1	..	..
<i>gibbula</i>	c	..	f	<i>stylifera</i>	2	..	..
<i>gracilis</i>.....	..	f	..	<i>Undinula darwinii</i>.....	..	r	..
<i>rostrata</i>	a	a	a				

Only 1° of difference in temperature in the upper 100 meters, and almost no difference in salinity and hydrogen-ion concentration. The three tows were of equal length, and the volume of the surface tow was from four to four and a half times that of the others. Thirty-two species (60 per cent) were each confined to a single level and 7 were present at all three levels. The vertical distribution was 25 species at the

surface, 34 at the 50-meter level, and 23 at the 100-meter level. *Candacia* and *Eucalanus* were each again reduced to a single species. *Corycaeus* was represented by 8 species and *Farranula* by 6, all well distributed in the three tows. But not a specimen of any of the 5 species of *Oncaea* appeared at the surface, although one of them, *O. minuta*, was abundant in the 50-meter tow.

STATION 48

November 25, 1928; 19° 06' S, 114° 07' W; bottom depth, 2874 m; 54 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	23.6	23.6	22.7	Density (σ_{tP})	24.8	25.0	25.4
Salinity, o/oo	36.4	36.4	36.2	Hydrogen-ion conc. (pH)	8.23	8.24	8.26
Volume of tow, cm ³	32	32	32	Length of tow, miles	1.1	1.5	1.5

<i>Acartia negligens</i>.....	..	f	2	<i>Labidocera detruncata</i>	a	1	4
<i>Acrocalanus gracilis</i>.....	..	..	f	<i>Lucicutia clausii</i>.....	..	..	f
<i>Calanus minor</i>.....	..	f	..	<i>flavicornis</i>.....	..	..	r
<i>Candacia bispinosa</i>.....	..	r	4	<i>Macrosetella oculata</i>.....	..	..	1
<i>simplex</i>.....	..	3	r	<i>Mecynocera clausi</i>.....	..	..	c
<i>truncata</i>.....	..	..	2	<i>Microcalanus pygmaeus</i>.....	..	1	f
<i>Centropages calaninus</i>.....	..	2	3	<i>Neocalanus gracilis</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>.....	..	r	r	<i>Oithona attenuata</i>	r	c	r
<i>furcatus</i>.....	..	c	f	<i>similis</i>.....	..	a	a
<i>Copilia denticulata</i>.....	..	1	1	<i>spirostris</i>	2	f	r
<i>Corycaeus agilis</i>	r	..	..	<i>Oithonina nana</i>.....	..	..	f
<i>andrewsi</i>.....	..	..	1	<i>Oncaea curta</i>.....	..	..	f
<i>catus</i>.....	..	..	2	<i>media</i>.....	..	..	c
<i>crassiusculus</i>	1	..	r	<i>minuta</i>.....	..	c	c
<i>flaccus</i>.....	..	..	f	<i>notopa</i>.....	..	..	f
<i>lautus</i>.....	..	..	2	<i>similis</i>.....	..	..	f
<i>limbatus</i>.....	..	1	f	<i>tenella</i>.....	..	..	r
<i>typicus</i>.....	..	..	f	<i>Onchocalanus nudipes, n. sp.</i>	1	..	..
<i>Euchaeta marina</i>.....	..	f	r	<i>Paracalanus parvus</i>.....	..	f	r
<i>Farranula carinata</i>.....	..	c	c	<i>Pleuromamma gracilis</i>.....	..	..	f
<i>concinna</i>	c	..	..	<i>Pontella tenuiremis</i>	r	..	..
<i>curta</i>.....	..	..	c	<i>Pontellina plumata</i>.....	..	..	1
<i>gibbula</i>	a	a	a	<i>Pontellopsis regalis</i>	2	..	..
<i>gracilis</i>.....	..	..	c	<i>Pseudocalanus minutus</i>.....	..	c	..
<i>rostrata</i>	a	a	a	<i>Spinocalanus abyssalis</i>.....	..	..	f
<i>Haloptilus longicornis</i>.....	..	..	f	<i>caudatus</i>.....	..	5	..
<i>Heterorhabdus papilliger</i>.....	..	..	2	<i>Undinula darwinii</i>.....	..	r	a

The temperature, salinity, and hydrogen-ion concentration were high and nearly the same at all three depths. The surface tow contained 11 species, the 50-meter tow 23, and the 100-meter tow 46. Thirty-three species (60 per cent) were confined to a single tow and only 5 were found in all three tows. The abundance of species in the 100-meter net coupled with

the paucity of those in the other tows suggests considerable intensity of light previous to the taking of the tows. The 8 species of *Corycaeus* and the 6 species of *Oncaea* were almost entirely in the 100-meter tow, but the 6 species of *Farranula* and the 3 of *Oithona* were well distributed in all three of the tows.

STATION 49

November 27, 1928; 23° 16' S, 114° 45' W; bottom depth, 3098 m; 62 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	23.3	22.5	21.6	Density (σ_{tp})	24.7	25.1	25.5
Salinity, ‰	36.1	36.0	35.9	Hydrogen-ion conc. (pH)	8.27	8.26	8.26
Volume of tow, cm ³	32	32	32	Length of tow, miles	1.0	0.6	1.6

<i>Acartia negligens</i>.....	..	..	2	<i>Labidocera detruncata</i>	r	..	..
<i>Acrocalanus gracilis</i>	3	4	f	<i>Lubbockia squillimana</i>.....	..	..	f
<i>Calanus minor</i>.....	..	c	..	<i>Lucicutia clausii</i>.....	..	..	c
<i>Calocalanus pavo</i>.....	..	2	2	<i>flavicornis</i>.....	..	..	1
<i>Candacia bispinosa</i>.....	..	..	r	<i>Mecynocera clausi</i>.....	..	2	3
<i>simplex</i>.....	..	..	c	<i>Metridia brevicauda</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>.....	..	r	r	<i>lucens</i>.....	..	..	1
<i>furcatus</i>	2	..	..	<i>Microcalanus pygmaeus</i>.....	..	..	a
<i>Copilia denticulata</i>.....	..	f	4	<i>Microsetella rosea</i>	1	..	r
<i>quadrata</i>.....	..	..	2	<i>Neocalanus gracilis</i>.....	..	f	c
<i>Corycaeus catus</i>.....	..	..	f	<i>tenuicornis</i>.....	..	3	2
<i>crassiusculus</i>.....	..	r	r	<i>Oithona attenuata</i>	r	f	f
<i>flaccus</i>.....	..	..	3	<i>similis</i>.....	..	c	a
<i>lautus</i>	3	c	c	<i>spinirostris</i>.....	..	a	c
<i>limbatus</i>	r	c	..	<i>Oncaea curta</i>.....	..	..	2
<i>longistylis</i>.....	..	2	2	<i>media</i>.....	..	..	r
<i>robustus</i>.....	..	1	r	<i>similis</i>.....	..	..	4
<i>speciosus</i>	2	f	f	<i>venusta</i>.....	..	..	r
<i>typicus</i>.....	..	a	a	<i>Paracalanus parvus</i>	2	..	f
<i>Euchaeta marina</i>.....	..	3	2	<i>Pleuromamma gracilis</i>.....	..	a	c
<i>Farranula carinata</i>.....	..	c	c	<i>quadrangulata</i>.....	..	..	1 ♀
<i>concinna</i>.....	..	..	r	<i>Pontella princeps</i>	f	..	..
<i>curta</i>.....	..	..	r	<i>tenuiremis</i>	a	..	..
<i>gibbula</i>	a	f	..	<i>Pontellina plumata</i>	1	1	1
<i>gracilis</i>.....	..	f	r	<i>Pseudocalanus minutus</i>	1	f	r
<i>rostrata</i>	c	a	..	<i>Sapphirina auronitens</i>	2	..	1
<i>Haloptilus acutifrons</i>.....	..	..	1	<i>nigromaculata</i>.....	..	2	1
<i>longicornis</i>.....	..	..	a	<i>scarlata</i>.....	..	3	..
<i>spiniceps</i>.....	..	..	2	<i>Spinocalanus abyssalis</i>.....	..	2	c
<i>Heterorhabdus papilliger</i>.....	..	..	4	<i>Undinula caroli</i>.....	..	3	..
<i>spinifrons</i>.....	..	..	c	<i>darwinii</i>.....	..	c	f

There was less than 2° difference in temperature and almost none in salinity and hydrogen-ion concentration in the upper 100 meters. Sixteen species were found at the surface, 32 in the 50-meter net, and 52 in the 100-meter net. Again the abundance of the 100-meter species together with the paucity of those at the surface suggests exceptional intensity of light before the tows. Thirty species (50 per cent) were each confined to a single tow, 23 of them to the 100-meter tow; 6

species were present in all three tows. The 9 *Corycaeus* species and the 6 *Farranula* species were again distributed through all three tows, but this time the 4 *Oncaea* species were wholly confined to the 100-meter tow. This would seem to indicate that *Oncaea* is more phototropic than *Corycaeus* or *Farranula*. The *Haloptilus* and *Heterorhabdus* species were also confined to the 100-meter tow. In it occurs the only record for *Pleuromamma quadrangulata*, of which a single female was taken.

BETWEEN STATIONS 49 AND 50
November 29, 1928; 26° 27' S, 115° 21' W; 40 species

Acartia negligens.....	1	Farranula curta.....	3	Oithona similis.....	c
Candacia aethiopica.....	2	gibbula.....	c	Oncaea curta.....	f
simplex.....	4	gracilis.....	c	minuta.....	c
Centropages calaninus.....	f	rostrata.....	a	similis.....	f
Clausocalanus arcuicornis.....	f	Labidocera detruncata.....	3	Paracalanus parvus.....	f
Copilia denticulata.....	2	Lucicutia clausii.....	f	Pleuromamma gracilis.....	3
Corycaeus crassiusculus.....	r	Macrosetella gracilis.....	1	Pontella princeps.....	1
lautus.....	f	Microcalanus pygmaeus.....	3	tenuiremis.....	1
limbatus.....	r	Microsetella rosea.....	2	Pontellina plumata.....	1
pumilus.....	2	Neocalanus gracilis.....	c	Pseudocalanus minutus.....	f
speciosus.....	r	robustior.....	2	Sapphirina auronitens.....	1
typicus.....	3	tenuicornis.....	2	Spinocalanus abyssalis.....	c
Euchaeta marina.....	r	Oithona attenuata.....	f	Undinula darwinii.....	a
Farranula carinata.....	c				

Volume of tow, 36 cm³; time, 12^h10^m to 2^h16^m A.M.; surface only. Twenty-one of the 40 species here taken at the surface were confined to the 50-meter and 100-meter levels at stations 49 and 50. Several others that were taken in the surface tow

at one or the other of those two regular stations are here found in greater numbers. We are thus furnished with good evidence of the nocturnal migration to the surface of considerably more than half of the species here listed.

STATION 50

November 29, 1928; 26° 27' S, 115° 21' W; bottom depth, 2837 m; 66 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	23.2	22.0	20.5	Density (σ_{tP})	24.6	25.1	25.6
Salinity, ‰	36.0	35.9	35.7	Hydrogen-ion conc. (pH)	8.23	8.23	8.22
Volume of tow, cm ³	32	32	32	Length of tow, miles	1.0	1.2	1.2

<i>Acartia negligens</i>.....	..	1	..	<i>Lucicutia flavicornis</i>.....	..	..	r
<i>Acrocalanus gracilis</i>.....	..	r	..	<i>Macrosetella gracilis</i>.....	..	1	..
<i>Aetideus armatus</i>.....	..	..	1	<i>Mecynocera clausi</i>.....	..	1	f
<i>Calanus tonsus</i>.....	..	..	1♂	<i>Metridia brevicauda</i>.....	..	..	f
<i>Calocalanus pavo</i>.....	..	1	..	<i>Microcalanus pusillus</i>.....	..	..	1
<i>styliremis</i>.....	..	..	2	<i>pygmaeus</i>.....	..	r	f
<i>Candacia simplex</i>.....	..	..	f	<i>Microsetella rosea</i>	2	..	1
<i>Centropages calaninus</i>	r	1	..	<i>Neocalanus gracilis</i>.....	..	f	f
<i>Clausocalanus arcuicornis</i>.....	..	r	r	<i>robustior</i>.....	..	..	r
<i>Clytemnestra scutellata</i>.....	..	1	..	<i>Oithona attenuata</i>.....	..	r	..
<i>Copilia denticulata</i>.....	..	1	..	<i>brevicornis</i>	2	..	..
<i>quadrata</i>.....	..	..	1	<i>similis</i>	c	c	c
<i>Corycaeus agilis</i>.....	..	..	1	<i>spinirostris</i>.....	..	r	..
<i>catus</i>.....	..	..	r	<i>Oncaea media</i>.....	..	..	f
<i>crassiusculus</i>.....	..	2	r	<i>minuta</i>.....	..	2	f
<i>flaccus</i>.....	..	4	3	<i>similis</i>.....	..	3	..
<i>lautus</i>	3	f	4	<i>subtilis</i>.....	..	..	2
<i>limbatus</i>.....	..	..	f	<i>tenella</i>.....	..	..	3
<i>longistylis</i>.....	..	..	1	<i>venusta</i>.....	..	..	2
<i>speciosus</i>	2	..	..	<i>Paracalanus parvus</i>	f	c	f
<i>typicus</i>.....	..	r	f	<i>Pleuromamma gracilis</i>.....	..	r	2
<i>Euchaeta acuta</i>.....	..	..	1	<i>Pontella atlantica</i>	1	..	..
<i>marina</i>.....	..	3	3	<i>princeps</i>	3	..	..
<i>Euchirella brevis</i>.....	..	..	1	<i>tenuiremis</i>	c	..	..
<i>Farranula carinata</i>.....	..	..	c	<i>Pontellina plumata</i>	1	..	..
<i>concinna</i>	r	..	..	<i>Pseudocalanus minutus</i>	f	f	..
<i>gibbula</i>	a	a	c	<i>Sapphirina auronitens</i>	4	1	..
<i>gracilis</i>	c	c	..	<i>nigromaculata</i>.....	..	1	1
<i>rostrata</i>	c	a	c	<i>Scolecithricella minor</i>.....	..	1♂	..
<i>Haloptilus longicornis</i>.....	..	..	f	<i>Spinocalanus abyssalis</i>.....	..	1	..
<i>spiniceps</i>.....	..	..	r	<i>caudatus</i>.....	..	1♀	..
<i>Heterorhabdus spinifrons</i>.....	..	3	..	<i>Undinula darwinii</i>.....	..	c	f
<i>Lucicutia clausii</i>.....	..	..	f	<i>Valdiviella minor</i>.....	..	..	1♀

Seventeen species were found at the surface, 34 at the 50-meter level, and 42 at the 100-meter level. Forty-five species, or about two-thirds, were each confined to a single tow, and only 5 were present in all three tows. There was less than 3° difference in the temperature at the three depths, and practically no difference in the salinity and hydrogen-ion concentration. The smaller species of *Corycaeus*, *Farranula*, and

Oncaea are much in evidence at this station. But again, whereas *Corycaeus* and *Farranula* species appear in all three tows, the *Oncaea* species are entirely absent from the surface. The 100-meter tow contains one of two records of *Valdiviella minor* outside the 1000-meter tow at station 64 (b). The two *Haloptilus* species are in the 100-meter tow, but *Heterorhabdus* appears in the 50-meter tow.

BETWEEN STATIONS 50 AND 51 (a)

November 30, 1928; 28° 38' S, 114° 59' W; 42 species

Tow	1	2	Tow	1	2
Volume of tow, cm ³	36	32	Length of tow, miles	2.3	2.9
Acrocalanus gracilis	f	f	Macrosetella oculata	..	2
Aetideus armatus	..	1	Metridia brevicauda	r	..
Calocalanus plumulosus	1	..	Microcalanus pusillus	2	..
Candacia aethiopica	..	2	Neocalanus gracilis	c	..
bispinosa	1	3	robustior	f	a
simplex	1	..	Oithona similis	..	c
truncata	1	1	Oncaea curta	r	3
Centropages calaninus	a	c	media	f	c
Clausocalanus arcuicornis	r	f	minuta	c	..
furcatus	3	..	similis	..	r
Corycaeus crassiusculus	r	..	subtilis	2	..
flaccus	..	r	tenella	..	2
lautus	2	..	Paracalanus parvus	c	..
pumilus	1	..	Pleuromamma abdominalis	1	f
Euchaeta marina	4	r	Pontella tenuiremis	a	..
Farranula carinata	f	c	Pontellina plumata	1	2
concinna	r	r	Pseudocalanus minutus	c	f
gibbula	c	c	Sapphirina nigromaculata	..	2
gracilis	f	r	Spinocalanus abyssalis	f	f
rostrata	a	a	Undinula caroli	..	r
Lucicutia clausii	..	f	darwinii	c	a

Time of first tow, 7^h35^m to 9^h P.M.; of second tow, 9^h20^m to 10^h30^m P.M. Surface only. These two tows, in conjunction with the one which follows, furnish exceptional evidence of nocturnal diversity of distribution among the surface copepods. These two were taken consecutively with the same net at the same locality. As the ship was becalmed and the interval between tows was only 20 minutes, the areas covered were so close together as to warrant no change in the record of latitude and longitude. The first was an 85-minute tow, the second a 70-minute tow, with a difference in volume cor-

responding to that in length. The two together yielded 42 species of copepods; 13 of these appeared in the first tow but not in the second, and 10 were found in the second tow but not in the first. This made a total of 23 species, or 55 per cent, which were confined to one of the localities. Furthermore, of the 19 species found in both tows, only 6 were credited with the same relative abundance, the other 13 showing notable differences. Hence 86 per cent of the entire catch shows more or less diversity of distribution, a remarkable result when the proximity of the two tows is taken into consideration.

BETWEEN STATIONS 50 AND 51 (b)

November 30, 1928; 28° 45' S, 114° 55' W; 44 species

Acartia negligens	2	Farranula gibbula	a	Oncaea media	a
Acrocalanus gracilis	f	gracilis	c	minuta	c
Candacia bispinosa	2	rostrata	c	similis	c
simplex	r	Heterorhabdus papilliger	1	venusta	2
Centropages calaninus	a	Labidocera detruncata	f	Paracalanus parvus	f
Clausocalanus arcuicornis	c	Lubbockia squillimana	1	Pleuromamma abdominalis	4
furcatus	r	Lucicutia clausii	a	Pontella tenuiremis	r
Corycaeus catus	1	flavicornis	f	Pontellina plumata	2
crassiusculus	r	Metridia longa	1	Pseudocalanus minutus	c
lautus	2	Microcalanus pygmaeus	1	Sapphirina auronitens	r
limbatus	3	Microsetella rosea	1	Spinocalanus abyssalis	c
typicus	r	Neocalanus robustior	a	caudatus	1
Euchaeta marina	2	Oithona similis	f	Undinula darwinii	a
Farranula carinata	c	Oncaea conifera	1	Valdiviella minor	4
concinna	c	curta	f		

Volume of tow, 36 cm³; length, 2.9 miles; time, 11^h17^m P.M. to 12^h30^m A.M. This third surface tow was taken with the same net later during the same night, but in the interval the ship had moved several miles from its former position. This tow contains 16 species that do not appear in the two former tows and it fails to show 14 species that were found there. In the three tows, therefore, 40 of the 58 species (70 per cent) appear

in a single tow only, and many of the remaining 30 per cent show marked differences in their relative abundance. *Valdiviella minor* here appears at the surface in the night, whereas the other two records are in the 100-meter tow at station 50 and the 100-meter tow at station 64. This species, then, is another that migrates to the surface in the night, but stays below 100 meters most of the time during the day.

STATION 51

December 1, 1928; 29° 06' S, 114° 48' W; bottom depth, 2898 m; 50 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	22.7	20.5	19.9	Density (σ_t)	24.4	25.3	25.7
Salinity, o/oo	35.6	35.5	35.6	Hydrogen-ion conc. (pH)	8.22	8.22	8.22
Volume of tow, cm ³	37	36	35	Length of tow, miles	1.6	1.2	1.2
<i>Acrocalanus gracilis</i>	c	..	r	<i>Lucicutia clausii</i>.....	..	..	f
<i>Calocalanus pavo</i>.....	..	..	2	<i>Macrosetella gracilis</i>	1	..	..
<i>Candacia bispinosa</i>.....	..	..	2	<i>Mecynocera clausi</i>.....	..	..	3
<i>simplex</i>.....	..	..	r	<i>Metridia brevicauda</i>.....	..	..	2
<i>Centropages calaninus</i>	f	..	..	<i>Microcalanus pygmaeus</i>.....	..	..	4
<i>Clausocalanus arcuicornis</i>	f	..	f	<i>Microsetella rosea</i>.....	..	3	f
<i>Clytemnestra scutellata</i>.....	..	..	1	<i>Neocalanus gracilis</i>.....	..	..	f
<i>Copilia denticulata</i>.....	..	..	2	<i>robustior</i>.....	..	..	f
<i>quadrata</i>.....	..	..	1	<i>tenuicornis</i>.....	..	..	2
<i>Corycaeus agilis</i>.....	..	..	r	<i>Oithona attenuata</i>.....	..	..	r
<i>catus</i>	a	..	f	<i>plumifera</i>.....	..	..	2
<i>crassiusculus</i>.....	..	1	3	<i>similis</i>.....	..	..	c
<i>lautus</i>	r	..	r	<i>spinirostris</i>.....	..	..	2
<i>limbatus</i>.....	..	..	r	<i>Oithonina nana</i>.....	..	..	2
<i>typicus</i>.....	..	1	f	<i>Oncaea media</i>.....	..	..	f
<i>Farranula carinata</i>	c	..	a	<i>minuta</i>.....	..	..	c
<i>concinna</i>	f	..	..	<i>similis</i>.....	..	..	c
<i>curta</i>	2	..	..	<i>Paracalanus parvus</i>.....	..	2	f
<i>gibbula</i>	a	..	a	<i>Pleuromamma gracilis</i>.....	..	..	4
<i>gracilis</i>	c	..	..	<i>Pontella tenuiremis</i>	f	..	..
<i>rostrata</i>.....	..	..	a	<i>Pontellina plumata</i>.....	..	..	1
<i>Haloptilus acutifrons</i>.....	..	..	1	<i>Pseudocalanus minutus</i>	c	1	c
<i>longicornis</i>.....	..	..	f	<i>Sapphirina auronitens</i>	4	..	..
<i>Heterorhabdus spinifrons</i>.....	..	..	5	<i>Undinula caroli</i>.....	..	..	r
<i>Labidocera detruncata</i>	f	..	..	<i>darwinii</i>.....	..	..	a

The temperature differed less than 3° in the 100 meters, and the salinity and hydrogen-ion concentration showed no variation. Fifteen species were found at the surface, only 5 in the 50-meter tow, and 42 in the 100-meter tow. Thirty-nine species (78 per cent) were each confined to a single tow and

only 1, *Pseudocalanus minutus*, was present in all three tows. In the small number of copepods, only 8 in all, that are recorded for the 50-meter net, this list differs radically from all the others. Something must have happened to this tow which does not appear anywhere in the records.

STATION 52

December 3, 1928; 31° 28' S, 112° 51' W; bottom depth, 2851 m; 52 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	22.4	20.1	18.2	Density (σ_{tP})	24.4	25.0	25.8
Salinity, o/oo	35.3	35.6	36.2	Hydrogen-ion conc. (pH)	8.21	8.20	8.17
Volume of tow, cm ³	36	37	48	Length of tow, miles	1.9	1.0	1.0

<i>Acartia negligens</i>.....	..	1	1	<i>Macrosetella gracilis</i>	2	..	..
<i>Acrocalanus gracilis</i>	2	..	r	<i>oculata</i>.....	..	..	1
<i>longicornis</i>.....	..	2	..	<i>Mecynocera clausi</i>.....	..	r	f
<i>Aetideus armatus</i>.....	..	..	3	<i>Microcalanus pygmaeus</i>.....	..	4	5
<i>Calocalanus pavo</i>.....	..	..	2	<i>Microsetella rosea</i>.....	..	..	r
<i>plumulosus</i>.....	..	..	1	<i>Neocalanus gracilis</i>.....	..	..	f
<i>Candacia simplex</i>.....	..	..	2	<i>robustior</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>	f	f	c	<i>Oithona attenuata</i>.....	..	a	..
<i>Copilia quadrata</i>.....	..	..	2	<i>similis</i>.....	..	a	a
<i>Corycaeus agilis</i>	1	..	..	<i>spirostris</i>.....	..	a	..
<i>catus</i>	a	r	r	<i>Oncaea curta</i>.....	..	3	3
<i>crassiusculus</i>.....	..	f	r	<i>minuta</i>.....	..	..	c
<i>flaccus</i>.....	..	..	1	<i>notopa</i>.....	..	..	3
<i>lautus</i>	3	..	4	<i>similis</i>.....	..	..	f
<i>typicus</i>.....	..	a	f	<i>tenella</i>.....	..	..	3
<i>Euaetideus giesbrechti</i>.....	..	..	2	<i>venusta</i>.....	..	..	f
<i>Euchaeta marina</i>.....	..	..	1	<i>Paracalanus parvus</i>.....	..	f	c
<i>Euchirella brevis</i>.....	..	..	1	<i>Pleuromamma abdominalis</i>.....	..	..	3
<i>Farranula carinata</i>	f	c	a	<i>gracilis</i>.....	..	1	r
<i>concinna</i>.....	..	r	..	<i>Pontella tenuiremis</i>	a	..	..
<i>gibbula</i>	c	c	f	<i>Pontellina plumata</i>.....	..	..	3
<i>rostrata</i>	c	c	a	<i>Pseudocalanus minutus</i>	f	..	c
<i>Haloptilus longicornis</i>.....	..	..	3	<i>Sapphirina auronitens</i>	1	..	..
<i>Heterorhabdus spinifrons</i>.....	..	..	4	<i>opalina</i>.....	..	..	2
<i>Lubbockia squillimana</i>.....	..	1	4	<i>Spinocalanus abyssalis</i>.....	..	..	r
<i>Lucicutia clausii</i>	2	..	..	<i>Undinula darwinii</i>	r	..	a

The temperature varied a little more than 4° at the three depths. The salinity rose a little and the hydrogen-ion concentration fell as the depth increased. Fourteen species were at the surface, 19 in the 50-meter tow, and 44 in the 100-meter net. Thirty-three species (63 per cent) were each confined to a single depth and only 5 appeared at all three depths. Of the 14 appearing at two depths, 8 showed a decided prefer-

ence for one depth over the other. The 6 species of *Oncaea* with one exception were confined to the 100-meter tow, and the 6 species of *Corycaeus* and the 4 species of *Farranula* were well distributed in all three tows. Although all 3 species of *Oithona* were found to be abundant in the 50-meter tow, it is to be noted that not a single specimen was found at the surface.

STATION 53

December 5, 1928; 29° 06' S, 108° 44' W; bottom depth, 2871 m; 66 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	22.5	21.2	19.9	Density (σ_{tP})	24.6	25.2	25.7
Salinity, ‰	35.7	35.7	35.6	Hydrogen-ion conc. (pH)	8.22	8.20	8.20
Volume of tow, cm ³	48	32	48	Length of tow, miles	1.7	2.0	2.0

<i>Acrocalanus gracilis</i>	2	r	f	<i>Macrosetella gracilis</i>.....	..	2	..
<i>Augaptilus longicaudatus</i>.....	..	..	1 ♀	<i>Mecynocera clausi</i>.....	..	..	f
<i>Calocalanus pavo</i>.....	..	2	f	<i>Metridia brevicauda</i>.....	..	..	r
<i>Candacia bispinosa</i>.....	..	..	4	<i>Microcalanus pusillus</i>.....	..	..	4
<i>simplex</i>.....	..	3	r	<i>pygmaeus</i>.....	..	..	f
<i>truncata</i>.....	..	..	1	<i>Microsetella rosea</i>.....	..	..	r
<i>Centropages calaninus</i>	1	2	..	<i>Miracia efferata</i>.....	..	1	..
<i>Clausocalanus arcuicornis</i>	1	f	..	<i>Neocalanus gracilis</i>.....	..	f	c
<i>furcatus</i>.....	..	..	3	<i>robustior</i>.....	..	..	f
<i>Copilia denticulata</i>.....	..	r	..	<i>Oithona attenuata</i>.....	..	f	..
<i>mirabilis</i>.....	..	..	3	<i>similis</i>.....	..	..	a
<i>Corycaeus catus</i>.....	..	..	1	<i>spinirostris</i>	1	f	..
<i>crassiusculus</i>.....	..	4	r	<i>Oithonina nana</i>.....	..	1	..
<i>flaccus</i>.....	..	..	2	<i>Oncaea curta</i>.....	..	..	3
<i>lautus</i>.....	..	f	f	<i>minuta</i>.....	..	c	c
<i>limbatus</i>.....	..	..	3	<i>notopa</i>.....	..	r	r
<i>longistylis</i>.....	..	..	5	<i>tenella</i>.....	..	..	r
<i>pumilus</i>.....	..	..	3	<i>Onchocalanus nudipes, n. sp.</i>	1	..	..
<i>typicus</i>.....	..	f	c	<i>Pachos punctatum, juv.</i>	1 ♀	..	..
<i>Euaetideus giesbrechti</i>.....	..	..	2	<i>Paracalanus parvus</i>	2	f	c
<i>Euchaeta acuta</i>.....	..	1	..	<i>Pleuromamma abdominalis</i>.....	..	..	r
<i>marina</i>.....	..	r	r	<i>gracilis</i>.....	..	f	f
<i>Euchirella pulchra</i>.....	..	..	1	<i>Pontella princeps</i>	2	..	..
<i>Farranula carinata</i>.....	..	c	c	<i>tenuiremis</i>	c	..	..
<i>gibbula</i>	c	..	c	<i>Pseudocalanus minutus</i>	3	c	..
<i>gracilis</i>	1	..	r	<i>Sapphirina auronitens</i>.....	..	1	..
<i>rostrata</i>.....	..	c	a	<i>opalina</i>.....	..	1	..
<i>Haloptilus longicornis</i>.....	..	..	a	<i>Scolecithricella bradyi</i>.....	..	1	..
<i>plumosus</i>.....	..	..	1	<i>Scolecithrix danae</i>.....	..	2	..
<i>spiniceps</i>.....	..	..	2	<i>Spinocalanus abyssalis</i>.....	..	c	f
<i>Heterorhabdus spinifrons</i>.....	..	..	2	<i>caudatus</i>.....	..	1	..
<i>Lubbockia squillimana</i>.....	..	1	r	<i>Undinula darwinii</i>.....	..	a	a
<i>Lucicutia clausii</i>.....	..	..	f	<i>Vettoria granulosa</i>.....	..	..	2

A difference of 2.6 in temperature between the three depths of tow (8^h 37^m to 9^h 45^m A.M.), with practically no difference in salinity or pH. Twelve species were taken at the surface, 32 at 50 meters, and 47 at 100 meters. Forty-three species (65 per cent) were each confined to a single depth, and only 2 appeared at all three depths. Again several species of each of the small genera *Corycaeus*, *Farranula*, and *Oncaea* were present in considerable numbers. At this station no specimen

of any of the 8 species of *Corycaeus* or the 4 species of *Oncaea* appeared in the surface tow, and only 1 specimen of 1 of the 3 species of *Oithona*. All these were well distributed in the other two tows. One specimen of the new species *Onchocalanus nudipes* was found in the surface tow. *Euchirella*, *Haloptilus*, *Heterorhabdus*, and *Augaptilus longicaudatus* were all confined to the 100-meter tow. The last mentioned was found in only two other localities, both in the eastern Pacific.

BETWEEN STATIONS 53 AND 54 (a)

December 6, 1928; 27° 09' S, 109° 26' W; * 36 species

<i>Acartia danae</i>	1	<i>Farranula rostrata</i>	a	<i>Oithonina nana</i>	2
<i>Acrocalanus gracilis</i>	f	<i>Lubbockia aculeata</i>	r	<i>Oncaea media</i>	f
<i>Clausocalanus arcuicornis</i>	f	<i>squillimana</i>	4	<i>minuta</i>	f
<i>furcatus</i>	a	<i>Lucicutia clausii</i>	2	<i>similis</i>	r
<i>Copilia denticulata</i>	4	<i>Mecynocera clausi</i>	f	<i>tenella</i>	r
<i>Corycaeus limbatus</i>	1	<i>Metis jousseau mei</i>	2 ♀	<i>Paracalanus aculeatus</i>	4
<i>typicus</i>	r	<i>Microsetella norvegica</i>	4	<i>parvus</i>	c
<i>Farranula carinata</i>	c	<i>Oithona attenuata</i>	2	<i>pygmaeus</i>	c
<i>concinna</i>	r	<i>brevicornis</i>	1	<i>Pleuromamma gracilis</i>	2
<i>curta</i>	r	<i>plumifera</i>	3	<i>Pseudocalanus minutus</i>	r
<i>gibbula</i>	a	<i>similis</i>	c	<i>Sapphirina nigromaculata</i>	3
<i>gracilis</i>	f	<i>spinirostris</i>	f	<i>Undinula darwinii</i>	2

*Anchorage, Hanga Roa, Easter Island.

These two surface tows were taken late in the afternoon and early evening (4^h 50^m to 6^h 40^m and 6^h 50^m to 9^h P.M.) at the anchorage off Easter Island. Although the water here was comparatively shallow and the anchorage was near the shore of the island, the only really littoral species appearing in the

catch was *Metis jousseau mei*. This is probably because of the fact that the towing was in an open roadstead and not in a landlocked harbor. None of the other surface tows from this anchorage yielded a single littoral species, only the pelagic forms that were common in the ocean around the island.

BETWEEN STATIONS 53 AND 54 (b)

December 10, 1928; 27° 09' S, 109° 26' W; * 28 species

<i>Acartia negligens</i>	2	<i>Farranula gibbula</i>	c	<i>Oncaea minuta</i>	2
<i>Acrocalanus gracilis</i>	r	<i>gracilis</i>	2	<i>tenella</i>	3
<i>Calanus minor</i>	r	<i>rostrata</i>	c	<i>Paracalanus aculeatus</i>	1
<i>Calocalanus plumulosus</i>	3	<i>Mecynocera clausi</i>	r	<i>parvus</i>	a
<i>Clausocalanus arcuicornis</i>	f	<i>Microcalanus pygmaeus</i>	2	<i>Pontella princeps</i>	2
<i>furcatus</i>	c	<i>Microsetella rosea</i>	3	<i>tenuiremis</i>	a
<i>Corycaeus lautus</i>	1	<i>Neocalanus gracilis</i>	3	<i>Pseudocalanus minutus</i>	f
<i>speciosus</i>	1	<i>Oithona attenuata</i>	1	<i>Sapphirina auronitens</i>	1
<i>Farranula carinata</i>	c	<i>similis</i>	1	<i>Undinula darwinii</i>	r
<i>curta</i>	4				

*Anchorage, Hanga Roa, Easter Island.

Four tows, surface only. The time of these tows was not recorded, but all four were on the same date. Like the two preceding tows, they were all in shallow water near the anchorage; they did not yield any littoral species. Eleven of the

species here recorded were not obtained in the two previous tows, and 19 present in those two tows do not appear here. *Calanus minor* and the 2 *Pontella* species, all 3 pelagic, are the most noteworthy additions in these four tows.

BETWEEN STATIONS 53 AND 54 (c)

December 12, 1928; 27° 25' S, 109° 25' W; 15 species

<i>Acrocalanus gracilis</i>	r	<i>Farranula carinata</i>	c	<i>Paracalanus parvus</i>	a
<i>Calanus minor</i>	r	<i>curta</i>	4	<i>Pontella princeps</i>	2
<i>Clausocalanus arcuicornis</i>	f	<i>gibbula</i>	c	<i>tenuiremis</i>	a
<i>furcatus</i>	c	<i>rostrata</i>	c	<i>Pseudocalanus minutus</i>	3
<i>Corycaeus lautus</i>	1	<i>Microcalanus pygmaeus</i>	2	<i>Sapphirina auronitens</i>	1

Two afternoon surface tows taken two days later than the previous ones and 2 miles northeast of Easter Island, where the water must have been considerably deeper. Many of the species captured nearer the island do not appear in these two

tows. Evidently there is a great diversity in the surface distribution of the copepods even within the narrow limits covered by these eight tows. The most noticeable difference here is the entire absence of *Oithona* and *Oncaea*.

STATION 54

December 14, 1928; 29° 17' S, 108° 54' W; bottom depth, 3061 m; 80 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	23.4	19.7	18.7	Density (σ_{tP})	24.2	25.3	25.8
Salinity, ‰	35.5	35.4	35.3	Hydrogen-ion conc. (pH)	8.22	8.18	8.16
Volume of tow, cm ³	36	36	36	Length of tow, miles	0.2	0.5	0.5

<i>Acartia negligens</i>.....	..	1	..	<i>Lucicutia curta</i>	2	..	..
<i>Acrocalanus gracilis</i>	c	c	f	<i>flavicornis</i>.....	..	..	c
<i>longicornis</i>.....	..	1	..	<i>longicornis</i>.....	..	..	2
<i>Calanus minor</i>.....	..	r	..	<i>Macrosetella gracilis</i>.....	..	1	1
<i>Calocalanus pavo</i>.....	..	2	f	<i>oculata</i>.....	..	..	3
<i>plumulosus</i>.....	..	1♂	..	<i>Mecynocera clausi</i>.....	..	f	c
<i>styliremis</i>.....	..	..	1	<i>Metridia brevicauda</i>.....	..	1	..
<i>Candacia longimana</i>.....	..	..	4	<i>Microcalanus pusillus</i>.....	..	..	r
<i>simplex</i>.....	..	..	3	<i>pygmaeus</i>.....	..	..	f
<i>truncata</i>.....	..	..	4	<i>Microsetella rosea</i>.....	..	..	f
<i>Canthocalanus pauper</i>.....	..	5	..	<i>Neocalanus gracilis</i>.....	..	r	c
<i>Centropages calaninus</i>.....	..	1	..	<i>robustior</i>.....	..	2	c
<i>Clausocalanus arcuicornis</i>	c	c	r	<i>tenuicornis</i>.....	..	..	2
<i>furcatus</i>	c	c	f	<i>Oithona attenuata</i>.....	..	r	c
<i>Clytemnestra scutellata</i>.....	..	..	1	<i>brevicornis</i>.....	..	..	2
<i>Copilia denticulata</i>.....	..	3	4	<i>plumifera</i>.....	..	..	2
<i>quadrata</i>.....	..	..	2	<i>similis</i>.....	..	c	a
<i>vitrea</i>.....	..	..	3	<i>spinirostris</i>.....	..	f	a
<i>Corycaeus catus</i>	1	r	f	<i>Oncaea curta</i>.....	..	..	2
<i>crassiusculus</i>.....	..	f	f	<i>media</i>.....	..	..	c
<i>dubius</i>.....	..	..	r	<i>mediterranea</i>.....	..	2	..
<i>flaccus</i>.....	..	r	r	<i>minuta</i>.....	..	c	c
<i>lautus</i>.....	..	c	r	<i>notopa</i>.....	..	f	r
<i>limbatus</i>.....	..	f	r	<i>similis</i>.....	..	f	f
<i>longistylis</i>.....	..	4	3	<i>tenella</i>.....	..	r	f
<i>typicus</i>.....	..	a	a	<i>venusta</i>.....	..	..	c
<i>Euchaeta acuta</i>.....	..	..	1	<i>Onchocalanus nudipes</i> , n. sp.	1♀	..	..
<i>marina</i>.....	..	..	1	<i>Paracalanus aculeatus</i>.....	..	..	1
<i>Euchirella brevis</i>.....	..	..	4	<i>parvus</i>	r	c	c
<i>Farranula carinata</i>	f	..	c	<i>pygmaeus</i>.....	..	..	r
<i>concinna</i>.....	..	..	r	<i>Pleuromamma gracilis</i>.....	..	a	a
<i>gibbula</i>	c	f	f	<i>Pontella tenuiremis</i>	c	..	..
<i>gracilis</i>	1	r	f	<i>Pseudocalanus minutus</i>	f	c	f
<i>rostrata</i>	c	c	c	<i>Sapphirina auronitens</i>	2	..	..
<i>Haloptilus longicornis</i>.....	..	..	a	<i>nigromaculata</i>.....	..	2	..
<i>Heterorhabdus papilliger</i>.....	..	..	f	<i>opalina</i>.....	..	2	..
<i>spinifrons</i>.....	..	..	f	<i>Undeuchaeta plumosa</i>.....	..	..	1
<i>Lubbockia aculeata</i>.....	..	1	r	<i>Undinula caroli</i>.....	..	..	r
<i>squillimana</i>.....	..	..	r	<i>darwinii</i>.....	..	..	r
<i>Lucicutia clausii</i>.....	..	..	a	<i>Vettopia granulosa</i>.....	..	..	1

The temperature was fairly high at the surface, and dropped nearly 4° at 50 meters and another degree at 100 meters. The salinity and hydrogen-ion concentration remained very nearly the same at all three depths. Fourteen species were taken in the surface tow, 40 in the 50-meter tow, and 66 in the 100-meter tow. Forty-nine species (61 per cent) were each confined to a single tow and 9 were found in all three tows. Though the surface tow was less than half the length of the other two, its volume was the same, but was evidently not due to the copepods it contained. The great difference in the number of species in the three tows suggests a strong light

for some time previous to the towing, and this assumption is reasonable considering that the station is in latitude 29° south and was occupied in the middle of summer. This is one of two records for *Lucicutia curta*, 2 specimens being found in the surface tow. The 8 species of *Corycaeus*, 5 of *Oithona*, and 8 of *Oncaea* were entirely confined to the two deeper tows, except a solitary specimen of *Corycaeus catus* taken at the surface. One specimen of the new *Onchocalanus* was captured in the surface tow. *Candacia*, *Euchaeta*, *Haloptilus*, *Heterorhabdus*, *Lucicutia*, and *Undeuchaeta* were all confined to the 100-meter tow, except *Lucicutia curta*.

STATION 55

December 16, 1928; 32° 03' S, 110° 55' W; bottom depth, 2725 m; 82 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	20.3	18.7	16.7	Density (σ_{tP})	24.6	25.3	25.9
Salinity, o/oo	34.9	35.0	34.8	Hydrogen-ion conc. (pH)	8.19	8.18	8.17
Volume of tow, cm ³	32	64	96	Length of tow, miles	0.3	0.8	1.4

<i>Acartia negligens</i>	1	1	3	<i>Lucicutia bicornuta</i>.....	..	2	..
<i>Acrocalanus gibber</i>.....	..	..	2	<i>clausii</i>.....	..	a	a
<i>gracilis</i>	r	f	r	<i>flavicornis</i>.....	..	r	f
<i>Aetideus armatus</i>.....	..	..	1	<i>Mecynocera clausi</i>.....	..	f	a
<i>Calocalanus pavo</i>.....	..	3	f	<i>Megacalanus longicornis</i>.....	..	..	1
<i>plumulosus</i>.....	..	2	..	<i>Microcalanus pusillus</i>.....	..	..	f
<i>styliremis</i>.....	..	..	1	<i>pygmaeus</i>.....	..	..	r
<i>Candacia bipinnata</i>.....	..	..	1	<i>Neocalanus gracilis</i>	f	c	c
<i>bispinosa</i>.....	..	..	3	<i>robustior</i>.....	..	c	f
<i>longimana</i>.....	..	3	..	<i>tenuicornis</i>.....	..	..	3
<i>norvegica</i>.....	..	..	1	<i>Oithona attenuata</i>	4	f	..
<i>simplex</i>.....	..	4	r	<i>brevicornis</i>.....	..	..	2
<i>truncata</i>.....	..	..	1	<i>similis</i>.....	..	c	a
<i>Canthocalanus pauper</i>.....	..	3	..	<i>spinirostris</i>.....	..	f	c
<i>Centropages hamatus</i>	1	..	..	<i>Oncaea curta</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>	2	c	f	<i>dentipes</i>.....	..	..	1 ♀
<i>furcatus</i>.....	..	f	c	<i>media</i>.....	..	c	c
<i>Copilia denticulata</i>.....	..	4	..	<i>mediterranea</i>.....	..	..	3
<i>quadrata</i>.....	..	..	2	<i>minuta</i>.....	..	a	a
<i>vitrea</i>.....	..	..	3	<i>notopa</i>	2	r	f
<i>Corycaeus catus</i>	4	r	r	<i>similis</i>.....	..	f	c
<i>crassiusculus</i>.....	..	..	f	<i>subtilis</i>.....	..	..	f
<i>flaccus</i>.....	..	..	r	<i>tenella</i>	2	r	f
<i>lautus</i>.....	..	r	r	<i>venusta</i>.....	..	f	a
<i>limbatus</i>.....	..	f	r	<i>Paracalanus parvus</i>	f	a	a
<i>longistylis</i>.....	..	..	2	<i>pygmaeus</i>.....	..	..	f
<i>pumilus</i>	3	..	..	<i>Phaenna spinifera</i>.....	..	4 ♂	..
<i>robustus</i>.....	..	..	1	<i>Pleuromamma gracilis</i>.....	..	a	2
<i>typicus</i>.....	..	a	c	<i>Pontella tenuiremis</i>	c	..	..
<i>Euaugaptilus filigerus</i>.....	..	..	1 ♀	<i>Pseudocalanus minutus</i>	r	r	f
<i>Eucalanus crassus</i>.....	..	..	1	<i>Sapphirina angusta</i>.....	..	1	2
<i>Euchaeta acuta</i>.....	..	..	r	<i>auronitens</i>.....	..	..	1
<i>Farranula carinata</i>	r	..	f	<i>opalina</i>.....	..	..	3
<i>concinna</i>	r	..	..	<i>salpae</i>.....	..	..	1
<i>curta</i>	1	..	c	<i>scarlata</i>.....	..	..	1
<i>gibbula</i>	c	c	f	<i>Scolecithricella auropecten</i>.....	..	..	f
<i>gracilis</i>	3	..	r	<i>bradyi</i>.....	..	2	r
<i>rostrata</i>	r	c	c	<i>Scolecithrix danae</i>.....	..	..	r
<i>Haloptilus longicornis</i>.....	..	f	1	<i>Spinocalanus abyssalis</i>.....	..	..	1
<i>Lubbockia aculeata</i>.....	..	3	..	<i>Undinula caroli</i>.....	..	..	f
<i>squillimana</i>.....	..	1	..	<i>darwinii</i>.....	..	r	a

The temperature at the surface was moderate and dropped 17 per cent in 100 meters; the salinity remained fairly constant, as did also the hydrogen-ion concentration. There were 19 species at the surface, 41 in the 50-meter tow, and 69 in the 100-meter tow. Forty-six species (56 per cent) were each confined to a single tow and 11 were present in all three tows. The 100-meter tow showed an exceptionally large

number of species of *Sapphirina*, and the only records for *Oncaea dentipes* and *Euaugaptilus filigerus*. *Centropages hamatus* is recorded from only one other station, 133, in the northern Pacific. *Candacia*, *Corycaeus*, *Oithona*, *Oncaea*, and *Sapphirina* were almost entirely confined to the two deeper tows, whereas each of the 6 *Farranula* species appeared at the surface.

STATION 56

December 18, 1928; 31° 49' S, 109° 04' W; bottom depth, 3135 m; 108 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	20.8	18.5	16.6	Density (σ_{tP})	24.5	25.4	25.8
Salinity, ‰	34.9	35.1	34.7	Hydrogen-ion conc. (pH)	8.13	8.14	8.11
Volume of tow, cm ³	48	32	48	Length of tow, miles	0.6	0.6	0.6
<i>Acartia danae</i>.....	..	1	2	<i>Lubbockia squillimana</i>.....	..	1	r
<i>negligens</i>.....	..	3	r	<i>Lucicutia clausii</i>.....	..	a	a
<i>Acrocalanus gibber</i>	2	r	f	<i>flavicornis</i>.....	..	r	r
<i>gracilis</i>	c	r	f	<i>longicornis</i>.....	..	2	..
<i>monachus</i>	2	..	..	<i>Macrosetella gracilis</i>	f	..	..
<i>Aetideus armatus</i>.....	..	..	1	<i>oculata</i>.....	..	..	3
<i>Calanus propinquus</i>.....	..	..	2	<i>Mecynocera clausi</i>	f	c	c
<i>tonsus</i>.....	..	2	2	<i>Megacalanus longicornis</i>.....	..	..	r
<i>Calocalanus pavo</i>.....	..	f	r	<i>Microcalanus pusillus</i>.....	..	r	f
<i>plumulosus</i>.....	..	1	2	<i>pygmaeus</i>.....	..	r	f
<i>styliremis</i>.....	..	2	..	<i>Microsetella rosea</i>.....	..	..	f
<i>Candacia bispinosa</i>.....	..	..	4	<i>Miracia efferata</i>	1	..	1
<i>longimana</i>.....	..	..	3	<i>Neocalanus gracilis</i>	r	c	a
<i>simplex</i>.....	..	3	c	<i>robustior</i>.....	..	c	a
<i>truncata</i>.....	..	..	2	<i>tenuicornis</i>.....	..	..	r
<i>Centropages calaninus</i>	3	..	3	<i>Oithona attenuata</i>.....	..	f	f
<i>elongatus</i>.....	..	..	1	<i>brevicornis</i>.....	..	..	3
<i>Clausocalanus arcuicornis</i>	a	f	f	<i>plumifera</i>.....	..	..	2
<i>furcatus</i>	a	f	f	<i>similis</i>	f	c	a
<i>Clytemnestra rostrata</i>.....	..	..	3	<i>spinirostris</i>.....	..	f	f
<i>scutellata</i>.....	..	1	1	<i>Oithonina nana</i>.....	..	..	3
<i>Copilia denticulata</i>.....	..	r	2	<i>Oncaea curta</i>.....	..	r	f
<i>quadrata</i>.....	..	2	4	<i>curvata</i>.....	..	2	..
<i>Corycaeus agilis</i>	r	4	..	<i>media</i>.....	..	c	c
<i>catus</i>	c	c	r	<i>mediterranea</i>.....	..	3	r
<i>crassiusculus</i>.....	..	r	f	<i>minuta</i>	f	a	..
<i>dubius</i>.....	..	r	..	<i>notopa</i>.....	..	r	r
<i>flaccus</i>.....	..	f	r	<i>similis</i>.....	..	r	c
<i>furcifer</i>.....	..	..	3	<i>subtilis</i>.....	..	f	..
<i>giesbrechti</i>.....	..	..	1	<i>tenella</i>.....	..	f	f
<i>lautus</i>	f	f	r	<i>venusta</i>.....	..	f	c
<i>limbatus</i>.....	..	2	r	<i>Pachos punctatum</i>.....	..	..	1
<i>longistylis</i>	f	..	r	<i>Paracalanus aculeatus</i>.....	..	2	4
<i>pacificus</i>.....	..	..	2	<i>parvus</i>	a	c	c
<i>pumilus</i>	c	c	2	<i>pygmaeus</i>.....	..	f	r
<i>robustus</i>.....	..	2	1	<i>Phaenna spinifera</i>.....	..	..	1
<i>typicus</i>.....	..	a	a	<i>Pleuromamma gracilis</i>.....	..	f	..
<i>Euaetideus giesbrechti</i>.....	..	..	3	<i>Pontella tenuiremis</i>	a	..	..
<i>Euchaeta acuta</i>.....	..	..	2	<i>Pontellina plumata</i>.....	..	..	1
<i>marina</i>	2	..	..	<i>Pseudocalanus minutus</i>	a	c	c
<i>Euchirella brevis</i>.....	..	2	..	<i>Sapphirina angusta</i>.....	..	1	..
<i>Euterpina acutifrons</i>.....	..	..	1	<i>auronitens</i>	2	..	2
<i>Farranula carinata</i>	r	a	c	<i>nigromaculata</i>.....	..	1	..
<i>curta</i>	c	c	a	<i>opalina</i>.....	..	..	r
<i>gibbula</i>	a	..	c	<i>Scaphocalanus medius</i>.....	..	..	1 ♀
<i>gracilis</i>	r	..	3	<i>Scolecithricella auropecten</i>.....	..	..	2
<i>rostrata</i>	f	a	c	<i>bradyi</i>.....	..	r	..
<i>Haloptilus acutifrons</i>.....	..	..	2	<i>minor</i>.....	..	..	2
<i>longicornis</i>.....	..	r	r	<i>Scolecithrix danae</i>.....	..	..	2
<i>plumulosus</i>.....	..	..	1	<i>Spinocalanus abyssalis</i>.....	..	r	4
<i>Heteramalla dubia</i>.....	..	..	1	<i>Undinopsis bradyi</i>.....	..	..	1 ♂
<i>Heterorhabdus papilliger</i>.....	..	..	2	<i>Undinula caroli</i>.....	..	..	f
<i>spinifrons</i>.....	..	2	..	<i>darwinii</i>.....	..	c	a
<i>Lubbockia aculeata</i>.....	..	4	f	<i>Vetтория granulosa</i>.....	..	1	3

The temperature at the surface was moderate, and dropped 2° at 50 meters and 2° more at 100 meters; the salinity and hydrogen-ion concentration showed but little change. Twenty-seven species were taken at the surface, 63 in the 50-meter tow, and 92 in the 100-meter tow. This last is the largest number of species taken in a single tow during the entire cruise. Forty-nine species (45 per cent) were each confined to a single depth and 15 were present at all three depths.

The 14 species of *Corycaeus* and the 10 species of *Oncaea* make the banner record for these two genera at any single station, and it is worth noting that these 24 species, together with the 5 species of *Oithona*, are distinctly congregated in the two deeper tows. *Aetideus*, *Candacia*, *Euaetideus*, *Haloptilus*, *Heterorhabdus*, and *Megacalanus* were also confined to

the two deeper tows; the same species of *Sapphirina* that appeared only in the 100-meter tow at station 55 were here distributed in all three tows. Although the surface tow yielded 27 species, the 2 species of *Clausocalanus*, 1 species of *Paracalanus*, and 1 of *Pseudocalanus* constituted together fully 90 per cent of the copepods, with the other species little more than stragglers. The 100-meter tow contains the only record of *Scaphocalanus medius* for the entire cruise, represented by a single specimen. The 2 species of *Acartia* and the 3 of *Calocalanus* did not show a single specimen in the surface tow, but the 5 species of *Farranula* were quite evenly distributed in all three tows. One species of *Macrosetella* was confined to the surface, the other appeared only in the 100-meter tow.

BETWEEN STATIONS 56 AND 57

December 19, 1928; 32° 27' S, 107° 22' W; 18 species

<i>Acrocalanus gracilis</i>	a	<i>Corycaeus pumilus</i>	f	<i>Oncaea notopa</i>	f
<i>Candacia bispinosa</i>	1	<i>Farranula gibbula</i>	4	<i>venusta</i>	f
<i>Centropages calaninus</i>	f	<i>rostrata</i>	f	<i>Pontella tenuiremis</i>	1
<i>Clausocalanus arcuicornis</i>	a	<i>Labidocera detruncata</i>	1	<i>Pseudocalanus minutus</i>	r
<i>furcatus</i>	a	<i>Macrosetella gracilis</i>	r	<i>Sapphirina auronitens</i>	2
<i>Corycaeus agilis</i>	1	<i>Oncaea minuta</i>	c	<i>opalina</i>	2

Volume of tow, 36 cm³; length, 1.3 miles; surface only. This tow is made up very largely (98 per cent) of *Acrocalanus* and *Clausocalanus* and contains no species that was not found at

regular station 56 or 57 except *Labidocera detruncata*. The time of the tow was not recorded, but it was probably a nocturnal one between stations while the vessel was becalmed.

STATION 57

December 20, 1928; 33° 59' S, 106° 43' W; bottom depth, 3139 m; 80 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	18.9	15.5	14.3	Density (σ_{tP})	24.6	25.5	26.1
Salinity, o/oo	34.4	34.3	34.3	Hydrogen-ion conc. (pH)	8.14	8.14	8.12
Volume of tow, cm ³	48	32	48	Length of tow, miles	1.2	1.2	1.2
<i>Acartia danae</i>	f	f	<i>Macrosetella oculata</i>.....	..	..	1
<i>negligens</i>	r	2	<i>Mecynocera clausi</i>.....	..	c	a
<i>Acrocalanus gibber</i>	c	r	<i>Megacalanus longicornis</i>.....	..	..	3
<i>gracilis</i>	a	c	<i>Microcalanus pusillus</i>.....	..	c	f
<i>Calanus minor</i>	2	..	<i>pygmaeus</i>.....	..	f	..
<i>Calocalanus pavo</i>	3	..	<i>Microsetella rosea</i>.....	..	..	1
<i>plumulosus</i>	2	<i>Miracia efferata</i>.....	..	..	1
<i>Candacia bispinosa</i>	2	<i>Neocalanus gracilis</i>.....	..	c	c
<i>simplex</i>	f	<i>robustior</i>.....	..	c	f
<i>Centropages calaninus</i>	2	<i>tenuicornis</i>.....	..	..	c
<i>Clausocalanus arcuicornis</i>	c	a	<i>Oithona attenuata</i>.....	..	r	r
<i>furcatus</i>	c	a	<i>brevicornis</i>.....	..	..	2
<i>Clytemnestra rostrata</i>	1	<i>plumifera</i>.....	..	..	3
<i>Copilia denticulata</i>	1	<i>similis</i>.....	..	a	a
<i>quadrata</i>	1	<i>spinirostris</i>.....	..	f	f
<i>Corycaeus catus</i>	2	5	f	<i>Oithonina nana</i>.....	..	r	r
<i>clausi</i>	1	<i>Oncaea media</i>.....	..	c	c
<i>crassiusculus</i>	f	f	<i>mediterranea</i>.....	..	f	f
<i>flaccus</i>	4	..	<i>minuta</i>.....	..	c	a
<i>furcifer</i>	5	<i>notopa</i>.....	..	c	r
<i>lautus</i>	c	..	<i>similis</i>.....	..	f	f
<i>limbatus</i>	r	..	<i>tenella</i>.....	..	c	..
<i>longistylis</i>	c	..	<i>venusta</i>.....	..	a	a
<i>pumilus</i>	f	r	..	<i>Paracalanus aculeatus</i>.....	..	2	r
<i>typicus</i>	c	c	<i>parvus</i>.....	..	c	a
<i>Eucalanus crassus</i>	1	<i>pygmaeus</i>.....	..	r	f
<i>elongatus</i>	1	<i>Phaenna spinifera</i>.....	..	..	1
<i>mucronatus</i>	1	<i>Pleuromamma gracilis</i>.....	..	..	3
<i>Euchaeta acuta</i>	c	<i>Pontella danae</i>.....	..	..	4
<i>Euchirella brevis</i>	2	..	<i>tenuiremis</i>	a	..	..
<i>Farranula carinata</i>	c	r	<i>Pontellina plumata</i>.....	..	1	..
<i>curta</i>	a	a	<i>Pseudocalanus minutus</i>	r	c	c
<i>gibbula</i>	r	<i>Sapphirina angusta</i>.....	..	1♂	1♀
<i>gracilis</i>	1	<i>auronitens</i>.....	..	..	2
<i>rostrata</i>	c	c	<i>nigromaculata</i>.....	..	..	2
<i>Haloptilus longicornis</i>	1	<i>Scolecithricella bradyi</i>.....	..	4	..
<i>plumosus</i>	1	<i>Scolecithrix danae</i>.....	..	a	a
<i>Lubbockia aculeata</i>	1	..	<i>Spinocalanus abyssalis</i>.....	..	3	3
<i>Lucicutia clausii</i>	c	<i>Undinula caroli</i>.....	..	r	r
<i>flavicornis</i>	r	<i>darwinii</i>.....	..	a	a

The moderate surface temperature dropped 3° at 50 meters and another degree at 100 meters; the salinity and hydrogen-ion concentration were fairly high and remained constant. Only 4 species appeared in the surface tow, 48 in the 50-meter tow, and 66 in the 100-meter tow. Forty-four species (55 per cent) were each confined to a single tow and only 2 were found in all three tows. Although the two genera *Corycaeus* and *Oncaea* do not come up to their record at station 56, they are still well represented in species—10 for the former and 7 for the latter. Of the 17 species, 2 species of *Corycaeus* are the

only ones that appear at the surface, the other 15 being confined to the two deeper tows. Although every one of the 5 species of *Farranula* appeared at the surface in goodly numbers at station 56, not one of the same 5 species was found here in the surface tow. This would seem to indicate that *Farranula* may become somewhat phototropic, although usually much less so than *Corycaeus* and *Oncaea*. All the specimens in the surface tow were very badly mutilated, and if this means an accident, it will go far toward explaining the exceptionally small number of species in that tow.

STATION 58

December 22, 1928; 36° 51' S, 104° 05' W; bottom depth, 3810 m; 36 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	16.9	14.8	12.3	Density (σ_{tP})	24.7	25.4	26.3
Salinity, o/oo	33.9	34.0	34.0	Hydrogen-ion conc. (pH)	8.12	8.12	8.09
Volume of tow, cm ³	448	36	96	Length of tow, miles	1.3	1.3	1.3

Acrocalanus gibber.....	..	..	3	Neocalanus gracilis.....	1	c	..
gracilis.....	..	c	..	robustior.....	..	f	f
Canthocalanus pauper.....	..	1	..	tenuicornis.....	..	f	..
Clausocalanus arcuicornis.....	..	c	..	Oithona brevicornis.....	..	..	2
furcatus.....	..	c	a	similis.....	..	..	c
Corycaeus crassiusculus.....	..	r	r	spinirostris.....	..	..	1
pumilus.....	..	3	..	Oithonina nana.....	..	2	..
typicus.....	..	..	1	Oncaea conifera.....	..	..	1
Eucalanus elongatus.....	..	2	..	media.....	..	c	..
Euchaeta acuta.....	..	..	f	minuta.....	..	a	c
Euchirella rostrata.....	..	..	1	similis.....	..	r	c
Farranula curta.....	..	f	..	venusta.....	..	f	c
rostrata.....	..	r	..	Paracalanus parvus.....	5	a	a
Lucicutia clausii.....	..	..	1	Pleuromamma gracilis.....	..	..	a
Mecynocera clausi.....	..	r	1	Pseudocalanus minutus.....	2	r	f
Megacalanus longicornis.....	..	..	1	Sapphirina angusta.....	..	..	c
Microcalanus pusillus.....	..	f	f	Scolecithrix danae.....	..	f	f
pygmaeus.....	..	f	f	Undinula darwinii.....	1	r	..

From a low surface temperature there was a drop of 4.5 in the upper 100 meters, and the salinity and hydrogen-ion concentration remained moderately high and constant. Only 4 species appeared at the surface, 24 in the 50-meter tow, and 25 in the 100-meter tow. Twenty-one species (60 per cent) were each confined to a single tow and only 2 were found in all three tows. This station is notable for the small number

of species found at the surface. This may be due to the fact that the great bulk of this tow was made up of ctenophores. These feed on copepods, among other creatures, and when they swarm in large numbers, as they were doing here, they would naturally reduce the number of the copepods. This would also help explain the great drop in number of species from 108 at station 56 and 80 at station 57 to 36 here.

STATION 59

December 24, 1928; 39° 51' S, 101° 04' W; bottom depth, 4116 m; 24 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	16.3	13.9	11.4	Density (σ_{tP})	24.9	25.6	26.5
Salinity, o/oo	33.9	33.9	34.1	Hydrogen-ion conc. (pH)	8.10	8.08	8.03
Volume of tow, cm ³	128	36	48	Length of tow, miles	0.8	1.0	1.0

Acrocalanus gracilis.....	f	r	f	Oithona attenuata.....	..	..	1
Clausocalanus arcuicornis.....	c	a	..	brevicornis.....	..	..	2
furcatus.....	c	a	c	similis.....	c	a	a
Corycaeus flaccus.....	..	1	..	spinirostris.....	..	3	..
Eucalanus elongatus.....	..	2	3	Oncaea mediterranea.....	..	..	2
mucronatus.....	..	..	1	similis.....	..	4	2
Euchaeta acuta.....	..	..	1	Paracalanus parvus.....	a	f	c
Euchirella rostrata.....	..	1	4	Pleuromamma gracilis.....	..	..	2
Farranula curta.....	..	..	1	Pseudocalanus minutus.....	..	f	r
Macrosetella gracilis.....	..	..	1	Sapphirina angusta.....	..	..	1
Mecynocera clausi.....	..	f	r	Scolecithrix danae.....	..	a	a
Neocalanus gracilis.....	..	f	c	Undinula darwinii.....	..	2	4

This station was next to the farthest south in the Pacific and hence showed a low surface temperature, with a fall of 5° in 100 meters. The salinity and hydrogen-ion concentration were moderate and changed very little. Five species were found at the surface, 15 in the 50-meter tow, and 21 in the 100-meter tow. Eleven species (46 per cent) were each confined to a single tow and 4 were found at all three depths.

Although the surface tow was shorter than the other two, its volume was three or four times as great. Again this was due to the large number of ctenophores it contained, which helps to explain the small number of surface copepods and the still further drop in the total number of copepod species. *Scolecithrix* and the 2 species of *Clausocalanus* composed a very large percentage of the 50-meter tow.

STATION 60

December 26, 1928; 40° 24' S, 97° 33' W; bottom depth, 4007 m; 12 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	14.9	13.4	10.6	Density (σ_t)	25.1	25.7	26.5
Salinity, o/oo	33.9	34.0	33.9	Hydrogen-ion conc. (pH)	8.07	8.06	8.03
Volume of tow, cm ³	64	36	36	Length of tow, miles	0.3	0.6	0.6

<i>Clausocalanus arcuicornis</i>	c	r	3	<i>Oncaea media</i>.....	..	..	1
<i>furcatus</i>	c	..	..	<i>Paracalanus parvus</i>	a	r	2
<i>Mecynocera clausi</i>.....	..	a	c	<i>pygmaeus</i>	c	r	..
<i>Microsetella rosea</i>.....	..	2	4	<i>Pseudocalanus minutus</i>	a	r	2
<i>Oithona brevicornis</i>.....	..	c	f	<i>Scolecithrix danae</i>.....	..	..	1
<i>similis</i>.....	..	a	a	<i>Undinula darwinii</i>.....	..	1	..

This station was the farthest south for the entire cruise and had a low surface temperature with a drop of 4° in the upper 100 meters; the salinity and hydrogen-ion concentration were moderate and constant. This is one of the lowest totals of species for stations in the Pacific, with 5 species at the surface, 9 in the 50-meter tow, and 9 in the 100-meter tow. Four species only were each confined to a single tow and 3 were present in all three tows. The length of the surface tow was only half that of the other two tows, but its volume was

nearly twice as great. Though the ctenophores were considerably reduced in number, they still made up the bulk of the surface tow. *Paracalanus* and *Pseudocalanus* were exceptionally abundant at the surface, *Mecynocera* and *Oithona similis* in the 50-meter tow, the latter in the 100-meter tow. *Corycaeus* was absent from this station and the following one, but reappeared between stations 61 and 62, and 5 species were present at the latter station. The fortieth parallel is probably a little too far south for this genus.

BETWEEN STATIONS 60 AND 61

- A. December 26, 1928, 4^h 50^m to 5^h 50^m P.M.; 40° 26' S, 97° 12' W
 B. December 26, 1928, 7^h 50^m to 10^h 20^m P.M.; 40° 22' S, 97° 02' W
 C. December 26, 1928, 10^h 25^m P.M. to 1^h A.M.; 40° 22' S, 96° 59' W

16 species

Location of tow	A	B	C	Location of tow	A	B	C
Volume of tow, cm ³	64	36	288	Length of tow, miles	3.0	1.8	1.6

<i>Acrocalanus gracilis</i>	r	..	..	<i>Oncaea curvata</i>.....	..	..	f
<i>Calanus tonsus</i>.....	..	f	f	<i>similis</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>	a	..	f	<i>Paracalanus parvus</i>	c	..	c
<i>furcatus</i>	c	..	f	<i>Pleuromamma gracilis</i>.....	..	..	r
<i>Microsetella rosea</i>.....	..	..	r	<i>Pseudocalanus minutus</i>	c	..	c
<i>Neocalanus gracilis</i>.....	..	..	r	<i>Scolecithrix danae</i>.....	..	..	f
<i>Oithona brevicornis</i>	a	f	r	<i>Undeuchaeta major</i>.....	..	..	1
<i>similis</i>	f	..	c	<i>Undinula darwinii</i>.....	..	..	r

These three surface tows were taken the same night but a few miles apart. The first tow, from 5^h to 6^h in the late afternoon, yielded 7 species; the second tow, from 8^h to 10^h in the evening, yielded only 2 species; and the third tow, over midnight, yielded 15 species. It is also worthy of note that the third tow, although shorter than the second, yielded a volume eight times as large, and this volume was four and a half times that of the first tow, although the latter was twice as long. That the midnight tow should contain twice as many species as either of the others is, however, exactly what would be expected as a result of nocturnal migration. The species found in it that were not present in the other tows

are the ones that require a longer time to reach the surface. This may be due to slower progress or to a longer distance traversed, *Undeuchaeta* probably coming under the latter alternative, and *Oncaea* perhaps representing the former. *Clausocalanus* and *Oithona* comprised 99 per cent of the first tow, the second tow was evenly divided between *Oithona* and *Calanus*, and no single species of the third tow stood out with any prominence. Nine of the species (56 per cent) were each confined to one of the tows, and only a single species was present in all three tows. These three tows thus present considerable diversity in the surface distribution of the copepods, apparently due to the time of day at which the hauls were made.

STATION 61

December 28, 1928; 38° 29' S, 94° 14' W; bottom depth, 3299 m; 26 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	16.9	14.0	10.7	Density (σ_{tP})	24.8	25.6	26.5
Salinity, o/oo	34.0	33.9	34.0	Hydrogen-ion conc. (pH)	8.05	8.05	8.03
Volume of tow, cm ³	320	36	36	Length of tow, miles	1.5	1.1	1.1

Calocalanus pavo.....	..	1	..	Neocalanus gracilis.....	1	..	f
plumulosus.....	..	f	4	tenuicornis.....	..	..	1
styliremis.....	..	..	2	Oithona brevicornis.....	..	..	f
Clausocalanus arcuicornis.....	f	..	f	similis.....	..	c	a
Eucalanus mucronatus.....	..	..	1	spirostris.....	..	c	a
Euchirella brevis.....	..	4	c	Oithonina nana.....	..	..	r
Farranula curta.....	..	1	..	Oncaea curvata.....	..	..	2
gibbula.....	..	1	..	similis.....	..	3	..
rostrata.....	..	2	..	Paracalanus parvus.....	c	r	..
Heterorhabdus papilliger.....	..	..	2	Pseudocalanus minutus.....	c	f	c
Heterostylites longicornis.....	..	..	1	Scolecithrix danae.....	..	..	4
Mecynocera clausi.....	..	a	c	Undinula darwinii.....	..	..	1
Microcalanus pygmaeus.....	..	1	..	Vettopia granulosa.....	..	..	1

The temperature was still low at the surface and dropped 6° in 100 meters; the salinity and hydrogen-ion concentration were moderate and constant. Four species were found at the surface, 13 in the 50-meter tow, and 19 in the 100-meter tow. Seventeen species (65 per cent) were each confined to a single tow and only 1 was present in all three tows. The length of the surface tow was four-tenths greater than that of the other

two tows, but its volume was nine times as large. Since it contained but 4 copepod species, 1 of which was represented by a single specimen, its bulk was manifestly due to plankton other than the copepods. The 50-meter tow contained 13 species, but more than 90 per cent of its copepods were *Mecynocera clausi*. Similarly, development stages of the 3 species of *Oithona* made up a large part of the 100-meter tow.

BETWEEN STATIONS 61 AND 62

A. December 28, 1928, 11^h 50^m P.M. to 2^h A.M.; 37° 35' S, 93° 35' WB. December 29, 1928, 2^h to 2^h 45^m A.M.; 37° 34' S, 93° 35' W

36 species

Location of tow	A	B	Location of tow	A	B
Volume of tow, cm ³	36	32	Length of tow, miles	0.4	2.2

Acartia danae.....	..	1	Oncaea mediterranea.....	f	f
Acrocalanus gracilis.....	1	..	minuta.....	c	f
Calocalanus plumulosus.....	..	f	notopa.....	r	..
Candacia simplex.....	..	1	similis.....	c	f
Clausocalanus arcuicornis.....	c	a	venusta.....	a	c
furcatus.....	c	a	Paracalanus parvus.....	f	a
Corycaeus agilis.....	1	f	pygmaeus.....	1	..
catus.....	2	c	Pleuromamma gracilis.....	c	1
crassiusculus.....	2	f	Pontella atlantica.....	1	..
pumilus.....	..	a	Pseudocalanus minutus.....	c	c
Farranula rostrata.....	1	f	Sapphirina angusta.....	1	2
Microcalanus pusillus.....	r	3	auronitens.....	..	1
pygmaeus.....	..	1	Scolecithricella bradyi.....	3	c
Microsetella rosea.....	c	f	marginata.....	1	..
Neocalanus gracilis.....	r	2	Scolecithrix danae.....	f	c
robustior.....	..	1	Spinocalanus abyssalis.....	c	c
Oithona similis.....	..	f	Undinula darwinii.....	f	a
Oncaea media.....	f	f	Vettopia granulosa.....	3	..

These two surface tows were taken at about the same time, only a mile apart. One yielded 28 species and the other 30. Fourteen species (40 per cent) were each confined to one of the tows, and 22 species (60 per cent) were present in both tows. This is a much more even distribution than that of the tows taken between stations 60 and 61. It is worthy of note

that although one tow covered a distance five and a half times as great as the other, the difference in volume is in favor of the shorter tow. Tow A contains one of three records of *Pontella atlantica* in the eastern Pacific. In both tows (taken near midnight), 5 of the 6 species of *Oncaea* appear in varied abundance; the sixth species was absent from tow B.

STATION 62

December 30, 1928; 34° 35' S, 91° 52' W; bottom depth, 3610 m; 36 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	19.2	16.2	13.1	Density (σ_{tP})	24.4	25.3	26.2
Salinity, ‰	34.2	34.2	34.1	Hydrogen-ion conc. (pH)	8.12	8.10	8.06
Volume of tow, cm ³	36	36	36	Length of tow, miles	0.1	0.1	0.1

<i>Acartia danae</i>.....	..	f	f	<i>Neocalanus tenuicornis</i>.....	..	..	1
<i>negligens</i>.....	..	..	1	<i>Oithona brevicornis</i>.....	..	r	..
<i>Acrocalanus gracilis</i>	1	f	r	<i>plumifera</i>.....	..	..	2
<i>Calocalanus plumulosus</i>.....	..	1	1	<i>similis</i>.....	..	f	..
<i>Clausocalanus arcuicornis</i>	f	a	c	<i>Oithonina nana</i>.....	..	2	..
<i>furcatus</i>.....	..	a	a	<i>Oncaea media</i>	2	c	c
<i>Clytemnestra scutellata</i>.....	..	2	..	<i>mediterranea</i>.....	..	c	f
<i>Corycaeus agilis</i>.....	..	4	..	<i>minuta</i>	f	..	..
<i>catus</i>.....	..	2	3	<i>notopa</i>.....	..	c	c
<i>crassiusculus</i>.....	..	5	r	<i>similis</i>.....	..	r	c
<i>lautus</i>.....	..	1	1	<i>venusta</i>.....	..	c	a
<i>typicus</i>.....	..	1	..	<i>Paracalanus parvus</i>	f	f	c
<i>Farranula curta</i>.....	..	a	a	<i>pygmaeus</i>.....	..	2	..
<i>rostrata</i>.....	..	f	..	<i>Pseudocalanus minutus</i>	f	r	f
<i>Mecynocera clausi</i>.....	..	c	c	<i>Sapphirina angusta</i>.....	..	1	2
<i>Microcalanus pygmaeus</i>.....	..	3	4	<i>Scolecithrix danae</i>.....	..	a	c
<i>Miracia efferata</i>.....	..	..	1	<i>Spinocalanus abyssalis</i>.....	..	f	..
<i>Neocalanus gracilis</i>.....	..	c	r	<i>Undinula darwini</i>.....	..	a	c

The temperature was moderate at the surface and fell 6° in 100 meters; the salinity and hydrogen-ion concentration were fairly high and about constant. Only 6 species were found at the surface, 31 in the 50-meter tow, and 26 in the 100-meter tow. Fourteen species (40 per cent) were each confined to a single tow and 5 were present in all three tows. The volume and length of the three tows were exactly the same,

although the copepod species were so unequally distributed. Compare the fact that the genera *Corycaeus*, *Farranula*, and *Oncaea* are here practically confined to the 50- and 100-meter tows with their abundant surface distribution in the two night tows which follow. Note also the lack of *Euaetideus*, *Megacalanus*, and *Undeuchaeta* in all three of these station tows and their presence at the surface in the night tows.

BETWEEN STATIONS 62 AND 63

A. December 31, 1928; 32° 23' S, 89° 42' W

B. December 31, 1928; 32° 25' S, 89° 49' W

50 species

Location of tow	A	B	Location of tow	A	B
<i>Acartia danae</i>	f	c	<i>Mecynocera clausi</i>.....	..	c
<i>negligens</i>	c	c	<i>Megacalanus longicornis</i>	4	..
<i>Acrocalanus gibber</i>	1	..	<i>Microcalanus pusillus</i>	4	3
<i>gracilis</i>	r	f	<i>Neocalanus gracilis</i>	f	..
<i>Calocalanus plumulosus</i>	1	..	<i>robustior</i>	2	..
<i>Candacia bispinosa</i>.....	..	1	<i>tenuicornis</i>.....	..	1
<i>norvegica</i>	2	..	<i>Oncaea curta</i>.....	..	r
<i>simplex</i>.....	..	r	<i>media</i>	a	f
<i>Clausocalanus arcuicornis</i>	c	a	<i>mediterranea</i>	f	c
<i>furcatus</i>	f	a	<i>minuta</i>	a	a
<i>Clytemnestra scutellata</i>	1	..	<i>notopa</i>	a	r
<i>Corycaeus agilis</i>.....	..	2	<i>similis</i>	f	r
<i>catus</i>	3	..	<i>tenella</i>	f	..
<i>crassiusculus</i>	f	..	<i>venusta</i>	a	a
<i>lautus</i>.....	..	1	<i>Paracalanus parvus</i>	c	a
<i>pumilus</i>	4	f	<i>pygmaeus</i>	c	..
<i>typicus</i>	f	..	<i>Pleuromamma gracilis</i>	c	..
<i>Euaetideus bradyi</i>	1	..	<i>Pontellina plumata</i>	1	..
<i>Farranula carinata</i>	c	..	<i>Pseudocalanus minutus</i>	c	a
<i>concinna</i>	c	..	<i>Scolecithrix danae</i>	f	..
<i>curta</i>	a	c	<i>Undeuchaeta major</i>	4	..
<i>gibbula</i>	a	..	<i>plumosa</i>	f	..
<i>gracilis</i>	c	..	<i>Undinula caroli</i>	f	..
<i>rostrata</i>	a	f	<i>darwinii</i>	a	a
<i>Lucicutia flavicornis</i>	1	..	<i>Vetтория granulosa</i>	2	..

These two surface tows were made on the same night 5 or 6 miles apart. Together they yielded 50 species, of which 43 were found in one tow and 25 in the other. Thirty-two species (64 per cent) were taken in one tow only, and 18 (36 per cent) were present in both tows. Here again is a striking diversity in the surface distribution of the copepods within a comparatively short distance. Since these tows were nocturnal and some of the species at least had come to the surface from be-

low, apparently the diverse distribution was not confined to surface species alone. The three small genera *Corycaeus*, *Farranula*, and *Oncaea* were especially well represented, and in tow A they constituted more than 90 per cent of the copepod plankton. *Euaetideus*, *Megacalanus*, and the two *Undeuchaeta* species were almost certainly migrants from below. The times of the tows were not recorded, but it is very probable that tow A was taken nearer midnight than the other.

STATION 63

January 1, 1929; 32° 10' S, 89° 04' W; bottom depth, 3393 m; 34 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	20.5	16.9	15.6	Density (σ_{tP})	24.3	25.4	25.9
Salinity, o/oo	34.6	34.5	34.5	Hydrogen-ion conc. (pH)	8.07	8.08	8.08
Volume of tow, cm ³	36	36	36	Length of tow, miles	0.1	0.1	0.1

<i>Acartia danae</i>	f	f	r	<i>Neocalanus gracilis</i>.....	..	f	r
<i>negligens</i>	a	f	..	<i>robustior</i>.....	..	f	..
<i>Acrocalanus gracilis</i>	a	c	..	<i>Oithona brevicornis</i>.....	..	3	..
<i>Clausocalanus arcuicornis</i>	a	a	r	<i>similis</i>.....	..	a	f
<i>furcatus</i>.....	..	r	1	<i>spinirostris</i>.....	..	2	..
<i>Corycaeus flaccus</i>.....	..	2	..	<i>Oncaea media</i>	r	c	1
<i>lautus</i>.....	..	1	..	<i>mediterranea</i>.....	..	c	r
<i>pumilus</i>	3	..	..	<i>minuta</i>	a	a	f
<i>typicus</i>.....	..	2	..	<i>notopa</i>.....	..	a	..
<i>Farranula carinata</i>.....	..	a	2	<i>tenella</i>.....	..	c	f
<i>curta</i>.....	..	a	c	<i>venusta</i>.....	..	a	..
<i>gracilis</i>.....	..	f	2	<i>Paracalanus parvus</i>.....	..	c	f
<i>rostrata</i>.....	..	a	r	<i>pygmaeus</i>.....	..	..	4
<i>Lucicutia clausii</i>.....	..	1	1	<i>Pseudocalanus minutus</i>	f	c	r
<i>Mecynocera clausi</i>.....	..	c	f	<i>Scolecithrix danae</i>.....	..	f	2
<i>Microcalanus pusillus</i>.....	..	2	..	<i>Undinula caroli</i>.....	..	f	..
<i>pygmaeus</i>.....	..	r	..	<i>darwinii</i>	r	f	2

The temperature was slightly higher at the surface and fell 5° in 100 meters; the salinity and hydrogen-ion concentration were moderate and constant. Nine species were taken at the surface, 32 in the 50-meter tow, and 20 in the 100-meter tow. Thirteen species (40 per cent) were each confined to a single tow and 6 were present in all three tows. This station is a comparatively short distance from the location of the two night tows just recorded. It is worthy of note that

the three small genera, *Corycaeus*, *Farranula*, and *Oncaea*, which were so abundant at the surface in those night tows, were almost entirely confined to the deeper tows the next forenoon. *Euaetideus*, *Megacalanus*, and *Undeuchaeta* did not appear at all in these station tows or in those of station 62, indicating that they really were migrants from below in the nocturnal tows and that they descended below 100 meters in the daytime.

BETWEEN STATIONS 63 AND 64 (a)

A. January 1, 1929, 3^h to 9^h P.M.; 32° 05' S, 88° 58' WB. January 1, 1929, 9^h to 12^h P.M.; 32° 03' S, 88° 55' WC. January 2, 1929, 12^h to 2^h A.M.; 32° 01' S, 88° 54' W

50 species

Location of tow Volume of tow, cm ³	A 48	B 48	C 32	Location of tow Length of tow, miles	A 0.1	B 0.6	C 0.1
<i>Acartia danae</i>	c	c	c	<i>Megacalanus longicornis</i>	5	..	..
<i>negligens</i>	f	f	c	<i>Microcalanus pusillus</i>	c	..	a
<i>Acrocalanus gibber</i>	c	f	2	<i>pygmaeus</i>	f	c	a
<i>gracilis</i>	c	c	c	<i>Neocalanus gracilis</i>.....	..	f	..
<i>Calanus propinquus</i> , juv.....	3	..	..	<i>robustior</i>	f	c	..
<i>Calocalanus plumulosus</i>	3	..	..	<i>Oncaea media</i>	c	c	f
<i>Candacia aethiopica</i>.....	..	1	..	<i>mediterranea</i>	f	r	r
<i>bispinosa</i>	3	..	..	<i>minuta</i>	a	a	a
<i>norvegica</i>	4	..	2	<i>notopa</i>	c	c	c
<i>simplex</i>	f	..	3	<i>subtilis</i>.....	..	..	3
<i>Centropages calaninus</i>	1	..	..	<i>tenella</i>	f	f	f
<i>Clausocalanus arcuicornis</i>	a	c	a	<i>venusta</i>	a	a	a
<i>furcatus</i>	c	f	c	<i>Paracalanus aculeatus</i>.....	..	..	f
<i>Corycaeus agilis</i>	1	r	f	<i>parvus</i>	c	c	c
<i>catus</i>	f	f	r	<i>pygmaeus</i>	r	..	f
<i>crassiusculus</i>	f	f	2	<i>Pleuromamma gracilis</i>.....	..	a	f
<i>pumilus</i>	f	a	f	<i>Pontella tenuiremis</i>.....	..	1	1
<i>Euchaeta acuta</i>.....	..	f	..	<i>Pseudocalanus minutus</i>	f	f	a
<i>Euchirella brevis</i>.....	..	1	..	<i>Sapphirina angusta</i>.....	..	1	..
<i>Farranula carinata</i>	f	f	..	<i>auronitens</i>.....	..	..	2
<i>concinna</i>.....	..	r	..	<i>Scolecithricella bradyi</i>	f	r	r
<i>curta</i>	a	a	c	<i>Scolecithrix danae</i>	f	..	f
<i>gibbula</i>	r	r	..	<i>Undeuchaeta plumosa</i>	3	..	..
<i>gracilis</i>	r	..	..	<i>Undinula caroli</i>	c	f	..
<i>rostrata</i>	a	c	c	<i>darwinii</i>	a	a	a

These are the first three of a series of nine surface tows taken between stations 63 and 64 on three successive nights. Two of the three here recorded were taken before midnight and one just after midnight of the same night. These three tows totaled 50 species, 39 in the first, 35 in the second, and 33 in the third tow. Sixteen species (32 per cent) were each confined to one of the tows, and 23 species, or almost half, were present in all three tows. *Corycaeus*, *Farranula*, and *Oncaea* were again abundant at the surface in all three tows, and

Megacalanus and *Undeuchaeta* reappeared from below. But not a solitary specimen of any species of *Oithona* appeared. In the tropics *Candacia aethiopica* is more often found in the deeper tows than at the surface. *Megacalanus* and *Undeuchaeta* appeared here at the surface earlier in the night, the first tow closing at 9 P.M., and *Candacia aethiopica* appeared later, the second tow running to midnight. Evidently a definite time cannot be fixed for the appearance of any species at the surface, since that time may vary by at least 3 hours.

BETWEEN STATIONS 63 AND 64 (b)

A. January 2, 1929, 2^h to 4^h A.M.; 32° 00' S, 88° 52' WB. January 2, 1929, 4^h to 8^h A.M.; 31° 58' S, 88° 50' WC. January 2, 1929, 10^h to 12^h P.M.; 31° 50' S, 88° 22' W

44 species

Location of tow	A	B	C	Location of tow	A	B	C
Volume of tow, cm ³	32	36	36	Length of tow, miles	0.1	0.1	0.2
<i>Acartia danae</i>	c	..	..	<i>Neocalanus gracilis</i>.....	..	r	..
<i>negligens</i>	f	c	c	<i>robustior</i>.....	..	..	2
<i>Acrocalanus gibber</i>	f	..	..	<i>Oithona brevicornis</i>.....	..	1	..
<i>gracilis</i>	a	r	r	<i>Oncaea curta</i>	c	..	..
<i>Candacia bispinosa</i>	2	..	..	<i>media</i>	c	1	..
<i>longimana</i>	2	..	..	<i>mediterranea</i>	f	..	f
<i>norvegica</i>	2	..	..	<i>minuta</i>	a	r	a
<i>simplex</i>.....	..	1	..	<i>notopa</i>	a	..	3
<i>Clausocalanus arcuicornis</i>	a	c	c	<i>similis</i>	r	..	..
<i>furcatus</i>.....	..	..	f	<i>subtilis</i>	r	..	..
<i>Corycaeus agilis</i>	f	..	..	<i>tenella</i>	c	..	2
<i>catus</i>	f	..	..	<i>venusta</i>	c	..	f
<i>crassiusculus</i>	r	..	..	<i>Paracalanus parvus</i>	f	a	c
<i>pumilus</i>	f	..	1	<i>pygmaeus</i>	a	f	r
<i>typicus</i>	2	..	..	<i>Phaenna spinifera</i>.....	..	2	..
<i>Euchaeta spinosa</i>.....	..	..	1	<i>Pleuromamma gracilis</i>.....	..	..	f
<i>Farranula curta</i>	c	..	f	<i>Pseudocalanus minutus</i>	a	a	c
<i>gibbula</i>	1	..	..	<i>Sapphirina auronitens</i>.....	..	..	1
<i>rostrata</i>	c	1	c	<i>Scolecithricella bradyi</i>	f	..	..
<i>Megacalanus longicornis</i>.....	..	..	4	<i>Undeuchaeta major</i>	5	..	..
<i>Microcalanus pusillus</i>.....	..	a	..	<i>Undinula caroli</i>.....	..	r	r
<i>pygmaeus</i>	a	f	..	<i>darwinii</i>	a	a	a

This is the second group of three nocturnal tows all taken on the same day, two in the early morning, and one in the late evening. The three yielded 44 species, 32 in A, 17 in B, and 22 in C. Twenty-six species (60 per cent) were each confined to a single tow and 9 were present in all three tows. Here also

we find *Megacalanus* and *Undeuchaeta* coming up from below, and *Corycaeus* and *Oncaea* present in tows A and C, but almost lacking in B. One specimen of *Oithona* was found in B, but none in A or C. Except for the 1000-meter tow at station 64, tow C contained the only record for *Euchaeta spinosa*.

BETWEEN STATIONS 63 AND 64 (c)

A. January 3, 1929, 12^h to 2^h A.M.; 31° 51' S, 88° 21' WB. January 3, 1929, 2^h to 4^h A.M.; 31° 52' S, 88° 20' WC. January 3, 1929, 4^h to 7^h 30^m A.M.; 31° 54' S, 88° 18' W

37 species

Location of tow Volume of tow, cm ³	A 36	B 36	C 36	Location of tow Length of tow, miles	A 0.1	B 0.1	C 0.1
<i>Acartia danae</i>.....	..	c	..	<i>Microcalanus pusillus</i>.....	..	..	1
<i>negligens</i>	r	c	..	<i>pygmaeus</i>	3	..	..
<i>Acrocalanus gibber</i>.....	..	r	..	<i>Neocalanus gracilis</i>	2	1	..
<i>gracilis</i>	c	c	a	<i>Oithona brevicornis</i>	2	..	..
<i>Calanus propinquus</i> , juv.....	f	..	..	<i>Oncaea curta</i>.....	..	r	..
<i>Candacia bispinosa</i>.....	..	1	..	<i>media</i>.....	..	f	..
<i>longimana</i>.....	..	2	..	<i>mediterranea</i>.....	..	r	..
<i>norvegica</i>	1	1	..	<i>minuta</i>	c	a	..
<i>simplex</i>.....	..	1	..	<i>notopa</i>	f	f	..
<i>Clausocalanus arcuicornis</i>	c	a	a	<i>venusta</i>	f	f	..
<i>furcatus</i>	c	r	a	<i>Paracalanus parvus</i>	a	c	a
<i>Corycaeus crassiusculus</i>.....	..	..	1	<i>pygmaeus</i>.....	..	c	..
<i>typicus</i>.....	..	2	..	<i>Pleuromamma gracilis</i>	f	..	..
<i>Euchaeta acuta</i>	2	..	..	<i>Pseudocalanus minutus</i>	c	f	f
<i>Farranula carinata</i>.....	..	r	..	<i>Sapphirina angusta</i>.....	..	1	..
<i>curta</i>	c	f	..	<i>auronitens</i>.....	..	1	..
<i>gracilis</i>.....	..	3	..	<i>Undinula caroli</i>.....	..	f	..
<i>rostrata</i>	c	c	..	<i>darwinii</i>	a	f	f
<i>Megacalanus longicornis</i>	3	..	1				

These are the last three of the nocturnal tows and were all taken the same night between midnight and morning. The three tows total 37 species: 20 in tow A, 29 in tow B, and 9 in tow C. Twenty-two species (60 per cent) were each confined to one tow and 6 were found in all three tows. *Corycaeus* is here reduced to a total of 3 specimens, and *Farranula* and

Oncaea are entirely absent from tow C, which was the latest of the three, in the early morning. *Megacalanus* was present in two of the tows, the earliest and the latest, but *Undeuchaeta* did not appear in any of them. *Candacia*, *Farranula*, and *Oncaea* were practically restricted to tow B, from 2^h to 4^h A.M. on January 3, 1929.

STATION 64 (a)

January 3, 1929; 31° 54' S, 88° 17' W; bottom depth, 3879 m; 31 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	20.6	17.2	15.8	Density (σ_{tP})	24.3	25.3	25.9
Salinity, o/oo	34.6	34.5	34.5	Hydrogen-ion conc. (pH)	8.12	8.12	8.10
Volume of tow, cm ³	80	36	36	Length of tow, miles	0.1	0.1	0.1

<i>Acartia danae</i>	f	c	c	<i>Neocalanus robustior</i>.....	..	..	1
<i>negligens</i>	a	c	c	<i>Oithona attenuata</i>.....	..	..	1
<i>Acrocalanus gibber</i>	r	..	r	<i>brevicornis</i>.....	..	..	c
<i>gracilis</i>	a	r	c	<i>similis</i>.....	..	c	a
<i>Candacia bispinosa</i>.....	..	..	1	<i>Oncaea curta</i>	2	..	..
<i>Clausocalanus arcuicornis</i>	a	r	c	<i>media</i>	r	..	c
<i>furcatus</i>	f	..	3	<i>mediterranea</i>.....	..	..	3
<i>Clytemnestra rostrata</i>.....	..	..	2	<i>minuta</i>	r	c	c
<i>Corycaeus lautus</i>.....	..	..	1	<i>notopa</i>.....	..	1	f
<i>Farranula curta</i>.....	..	1	a	<i>venusta</i>.....	..	..	r
<i>rostrata</i>.....	..	..	r	<i>Paracalanus parvus</i>	c	c	c
<i>Mecynocera clausi</i>.....	..	a	a	<i>pygmaeus</i>.....	..	f	r
<i>Megacalanus longicornis</i>.....	..	..	2	<i>Pseudocalanus minutus</i>	r	r	f
<i>Microcalanus pusillus</i>.....	..	1	..	<i>Undinula darwinii</i>.....	..	..	c
<i>pygmaeus</i>.....	..	..	1	<i>Vettopia granulosa</i>.....	..	..	1
<i>Neocalanus gracilis</i>.....	..	..	f				

These tows were made at the regular station depths. The temperature was moderate at the surface and dropped 5° in the 100 meters, but the salinity and hydrogen-ion concentration remained practically constant. Eleven species were found at the surface, 13 in the 50-meter tow, and 29 in the 100-meter tow. Sixteen species (51 per cent) were each confined to a single depth and 7 were present at all three depths.

Corycaeus was reduced to a single specimen in the 100-meter tow; *Farranula* and *Oithona* were confined to the two deeper tows and did not appear at the surface; *Oncaea* was distributed at all three depths. *Candacia*, *Megacalanus*, and *Neocalanus* were found only in the 100-meter tow, and hence had descended from the surface, where they had been found earlier in the morning, but had not gone below 100 meters.

STATION 64 (b)

January 3, 1929; 31° 54' S, 88° 17' W; bottom depth, 3879 m; 74 species

<i>Acartia danae</i>	f	<i>Gaidius tenuispinus</i>	3	<i>Oncaea media</i>	1
<i>negligens</i>	r	<i>Haloptilus acutifrons</i>	1	<i>mediterranea</i>	r
<i>Acrocalanus gracilis</i>	c	<i>longicornis</i>	1	<i>notopa</i>	r
<i>Amallophora typica</i>	2 ♀	<i>plumosus</i>	1	<i>similis</i>	f
<i>Amallothrix valida</i>	2	<i>Heterorhabdus abyssalis</i>	3	<i>tenella</i>	3
<i>Centropages calaninus</i>	1	<i>compactus</i>	1 ♀	<i>venusta</i>	c
<i>Chiridiella sp.</i> , immature.....	3	<i>papilliger</i>	1	<i>Onchocalanus cristatus</i>	1 ♀
<i>Chiridius poppei</i>	1 ♀	<i>Heterostylites longicornis</i>	1 ♂	<i>trigoniceps</i>	1 ♀
<i>Clausocalanus arcuicornis</i>	c	<i>Lophothrix frontalis</i>	1	<i>Pareuchaeta incisa</i>	4 ♀
<i>Corycaeus flaccus</i>	2	<i>humilifrons</i>	1	<i>Phaenna spinifera</i>	1
<i>lautus</i>	1	<i>Lucicutia clausii</i>	3	<i>Phyllopus helgae</i>	3 ♀
<i>longistylis</i>	3	<i>flavicornis</i>	1	<i>Pleuromamma abdominalis</i>	2
<i>Eucalanus crassus</i>	1	<i>longicornis</i>	4	<i>gracilis</i>	a
<i>elongatus</i>	3	<i>Mecynocera clausi</i>	c	<i>robusta</i>	3
<i>mucronatus</i>	2	<i>Megacalanus longicornis</i>	1	<i>xiphias</i>	5
<i>Euchaeta acuta</i>	2	<i>princeps</i>	2	<i>Pseudochirella divaricata</i>	1 ♀
<i>spinosa</i>	f	<i>Metridia longa</i>	4	<i>Scaphocalanus magnus</i>	1 ♀
<i>Euchirella intermedia</i>	3	<i>lucens</i>	2	<i>Scolecithricella auropecten</i>	5
<i>messinensis</i>	1	<i>princeps</i>	3 ♀	<i>bradyi</i>	2
<i>rostrata</i>	1 ♂	<i>Neocalanus gracilis</i>	2	<i>Scolecithrix danae</i>	2
<i>Gaetanus armiger</i>	4	<i>robustior</i>	1	<i>Undeuchaeta major</i>	3
<i>kruppii</i> , immature.....	1 ♂	<i>Oithona similis</i>	r	<i>plumosa</i>	3
<i>miles</i>	1	<i>spinirostris</i>	2	<i>Undinula darwinii</i>	f
<i>minor</i>	3	<i>Oncaea conifera</i>	c	<i>Valdiviella minor</i>	1
<i>Gaidius affinis</i>	1	<i>curta</i>	f		

This is the only instance during the entire cruise when a towing was made below 100 meters. Here the net was lowered to 1000 meters, drawn horizontally for 160 meters, and then raised to the surface. The temperature was 3.8 C; the salinity, 34.3 o/oo; the density, 32.0; the hydrogen-ion concentration, 7.76; volume of tow, 64 cm³; length of tow, 0.1 mile. Since the net employed could not be closed, we have a combination of a horizontal tow at a depth of 1000 meters and a vertical tow from 1000 meters to the surface. As would be expected, we find here many species (16) which were not obtained in any other tow, and 4 others 1 of which was found elsewhere in a 100-meter tow and 3 in a surface tow. Another noteworthy fact is that 59 of the 74 species (80 per cent) were represented by 5 individuals or less, 27 of them by solitary specimens. Hence, although this deep tow added materially to the num-

ber of species obtained, it was very meager in individual specimens. *Pleuromamma gracilis* is recorded as abundant and 5 species are recorded as common; these are all, except *Oncaea conifera*, abundant in the upper 100 meters, and of course may have been obtained there as the net was drawn to the surface. Since the net was drawn horizontally at a depth of 1000 meters for a reasonable distance, the paucity of specimens in the case of the 9 species mentioned above would seem to suggest that none of them congregates at a depth of 1000 meters. On the contrary, their downward migration during the daytime probably stops at a level between 100 and 1000 meters. That would explain why they were not taken in the regular 100-meter tow, and why so few of them were captured as the net passed vertically upward through the level where they had stopped.

BETWEEN STATIONS 64 AND 65 (a)

A. January 3, 1929, 10^h to 12^h P.M.; 31° 52' S, 87° 51' WB. January 4, 1929, 0^h to 2^h A.M.; 31° 52' S, 87° 46' W

40 species

Location of tow	A	B	Location of tow	A	B
Volume of tow, cm ³	32	32	Length of tow, miles	0.6	2.4
<i>Acartia danae</i>	c	r	<i>Neocalanus robustior</i>	2	..
<i>negligens</i>	c	c	<i>tenuicornis</i>.....	..	r
<i>Acrocalanus gibber</i>	4	.	<i>Oithona similis</i>	r	..
<i>gracilis</i>	c	r	<i>Oncaea curta</i>	f	r
<i>Candacia norvegica</i>.....	..	2	<i>media</i>.....	..	r
<i>simplex</i>.....	..	3	<i>mediterranea</i>	r	r
<i>Clausocalanus arcuicornis</i>	a	f	<i>minuta</i>	a	c
<i>furcatus</i>	f	4	<i>notopa</i>	f	c
<i>Clytemnestra rostrata</i>	1	..	<i>similis</i>	r	..
<i>Corycaeus agilis</i>.....	..	1	<i>tenella</i>	f	c
<i>crassiusculus</i>.....	..	5	<i>venusta</i>	r	f
<i>speciosus</i>	3	..	<i>Paracalanus parvus</i>	a	a
<i>Farranula carinata</i>.....	..	r	<i>pygmaeus</i>	f	f
<i>curta</i>	c	c	<i>Pleuromamma gracilis</i>	f	3
<i>gracilis</i>.....	..	3	<i>Pseudocalanus minutus</i>	f	f
<i>rostrata</i>	c	c	<i>Sapphirina opalina</i>.....	..	1
<i>Macrosetella gracilis</i>	2	..	<i>Scolecithrix danae</i>.....	..	1
<i>Megacalanus longicornis</i>	3	4	<i>Spinocalanus abyssalis</i>	1	..
<i>Microsetella norvegica</i>	2	..	<i>Undinula caroli</i>.....	..	r
<i>Neocalanus gracilis</i>	f	f	<i>darwinii</i>	a	a

These two surface tows were taken on the same night about 5 miles apart. Twenty-nine species were taken in tow A, just before midnight, and 31 in tow B, just after midnight. Twenty of the species, or exactly half, were each confined to one of the tows, and the other 20 were present in both tows. The volume of the two tows was exactly the same although tow B was four times the length of A. The copepod species must have been considerably more numerous just before mid-

night than after, as would be expected. But the greater length of the early morning tow more than offset the superior abundance in the one before midnight and produced 2 more species. *Oncaea* surpassed *Corycaeus* and *Farranula* combined, both in number of species and in abundance. *Megacalanus* appears in both tows and evidently does not always begin its downward migration from the surface promptly.

BETWEEN STATIONS 64 AND 65 (b)

A. January 4, 1929, 2^h to 4^h A.M.; 31° 52' S, 87° 42' WB. January 4, 1929, 6^h 45^m to 10^h P.M.; 31° 31' S, 86° 57' W

44 species

Location of tow	A	B	Location of tow	A	B
Volume of tow, cm ³	32	36	Length of tow, miles	1.6	2.0
<i>Acartia danae</i>	c	c	<i>Megacalanus longicornis</i>	3	..
<i>negligens</i>	c	..	<i>Neocalanus gracilis</i>	f	3
<i>Acrocalanus gracilis</i>	f	r	<i>robustior</i>	2	..
<i>Calocalanus plumulosus</i>.....	..	1	<i>Oithona similis</i>	1	..
<i>Candacia norvegica</i>	4	4	<i>Oncaea curta</i>	f	..
<i>Centropages calaninus</i>	2	..	<i>media</i>	c	r
<i>Clausocalanus arcuicornis</i>	a	f	<i>mediterranea</i>	c	r
<i>furcatus</i>	c	f	<i>minuta</i>	a	..
<i>Clytemnestra rostrata</i>	1	..	<i>notopa</i>	a	..
<i>Corycaeus agilis</i>	3	1	<i>similis</i>	r	..
<i>catus</i>	1	..	<i>tenella</i>	a	..
<i>clausi</i>	2	..	<i>venusta</i>	a	a
<i>crassiusculus</i>	f	..	<i>Paracalanus parvus</i>	c	c
<i>flaccus</i>	3	..	<i>pygmaeus</i>	f	..
<i>pumilus</i>	r	..	<i>Pleuromamma gracilis</i>	f	4
<i>speciosus</i>	f	..	<i>Pseudocalanus minutus</i>	c	r
<i>typicus</i>	f	..	<i>Sapphirina auronitens</i>	1	..
<i>Farranula carinata</i>	c	..	<i>pyrosomatis</i>.....	..	1
<i>curta</i>	a	f	<i>salpae</i>	1	..
<i>gibbula</i>	r	..	<i>Scolecithricella bradyi</i>	2	..
<i>rostrata</i>	a	..	<i>Undeuchaeta plumosa</i>	4	..
<i>Mecynocera clausi</i>	1	..	<i>Undinula darwinii</i>	a	a

Two surface tows taken the same day at a considerable distance apart, tow A in the early morning and tow B in the late evening. Of the total of 44 species, tow A contained all but 2, and tow B only 17. Twenty-nine species (66 per cent) were confined to one tow and 15 were found in both tows.

The great difference in the number of species in the two tows is good evidence that the downward migration begins at or shortly after midnight. *Megacalanus* was confined to the tow shortly after midnight, and had not reached the surface at 10 P.M.

STATION 65

January 5, 1929; 31° 07' S, 86° 39' W; bottom depth, 3626 m; 42 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	20.2	16.5	14.8	Density (σ_{tP})	24.3	25.4	25.9
Salinity, o/oo	34.5	34.4	34.2	Hydrogen-ion conc. (pH)	8.10	8.10	8.10
Volume of tow, cm ³	96	32	48	Length of tow, miles	0.9	0.5	0.5

<i>Acartia danae</i>	2	c	c	<i>Metridia lucens</i>.....	..	4	..
<i>negligens</i>	3	c	f	<i>Microcalanus pygmaeus</i>.....	..	1	..
<i>Acrocalanus gibber</i>	3	4	..	<i>Microsetella rosea</i>.....	..	..	f
<i>gracilis</i>	c	c	f	<i>Neocalanus gracilis</i>.....	..	..	f
<i>Calanus minor</i>.....	..	f	f	<i>robustior</i>.....	..	..	2
<i>Calocalanus plumulosus</i>.....	..	2	..	<i>tenuicornis</i>.....	..	..	f
<i>Candacia simplex</i>.....	..	1	..	<i>Oithona attenuata</i>.....	..	..	2
<i>Clausocalanus arcuicornis</i>	a	a	c	<i>fallax</i>.....	..	..	a
<i>Corycaeus agilis</i>	f	..	..	<i>setiger</i>.....	..	..	f
<i>dubius</i>	r	..	..	<i>similis</i>	f	c	a
<i>flaccus</i>	r	..	..	<i>spirostris</i>.....	..	..	c
<i>pacificus</i>.....	..	..	3	<i>Oncaea minuta</i>.....	..	a	a
<i>pumilus</i>.....	..	..	2	<i>venusta</i>	1	a	a
<i>typicus</i>.....	..	f	..	<i>Paracalanus parvus</i>	4	c	f
<i>Farranula carinata</i>.....	..	..	c	<i>pygmaeus</i>.....	..	f	..
<i>gibbula</i>	f	..	..	<i>Pleuromamma abdominalis</i>.....	..	..	1
<i>rostrata</i>.....	..	f	c	<i>gracilis</i>.....	..	..	1
<i>Heterorhabdus papilliger</i>.....	..	..	4	<i>Pseudocalanus minutus</i>	f	c	c
<i>Lucicutia clausii</i>.....	..	..	1	<i>Sapphirina salpae</i>.....	..	..	5
<i>flavicornis</i>.....	..	1	f	<i>Scolecithrix danae</i>.....	..	f	f
<i>Mecynocera clausi</i>.....	..	c	a	<i>Undinula darwinii</i>.....	..	..	c

The temperature was moderate at the surface and dropped 5.5° in 100 meters; the salinity and hydrogen-ion concentration were fairly high and constant. Thirteen species were taken at the surface, 21 in the 50-meter tow, and 31 in the 100-meter tow. Twenty-seven species (64 per cent) were each confined to a single tow and 8 were present in all three tows. *Corycaeus*, *Farranula*, and *Oithona* were well represented in species, and although there were only 2 species of *Oncaea* they were both abundant in the two deeper tows. The 4

specimens of *Metridia lucens* in the 50-meter tow constituted the largest number of the species taken at any station in the eastern Pacific. *Mecynocera*, which was represented by a single specimen in the four preceding surface tows, is here common in the 50-meter tow and abundant in the 100-meter tow. *Heterorhabdus*, the three *Neocalanus* species, and *Pleuromamma* appear only in the 100-meter tow. The surface tow was virtually an exclusive colony of *Clausocalanus*, the other species combined falling below 10 per cent.

STATION 66

January 7, 1929; 27° 04' S, 84° 01' W; bottom depth, 3812 m; 45 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	19.4	17.8	17.8	Density (σ_{tP})	24.6	25.4	25.7
Salinity, ‰	34.6	34.8	34.9	Hydrogen-ion conc. (pH)	8.10	8.10	8.12
Volume of tow, cm ³	64	....	64	Length of tow, miles	1.7	....	1.7

<i>Acartia danae</i>	c	..	2	<i>Heterorhabdus papilliger</i>.....	..	..	3
<i>negligens</i>	c	..	4	<i>Lubbockia squillimana</i>.....	..	..	3
<i>Acrocalanus gibber</i>	5	..	f	<i>Lucicutia flavicornis</i>.....	..	..	c
<i>gracilis</i>	f	..	f	<i>Mecynocera clausi</i>	c	..	c
<i>longicornis</i>.....	..	..	3	<i>Microsetella rosea</i>.....	..	..	f
<i>Calanus propinquus</i>.....	..	..	2	<i>Neocalanus gracilis</i>.....	..	..	c
<i>Calocalanus pavo</i>.....	..	..	1	<i>robustus</i>.....	..	..	f
<i>Candacia bipinnata</i>.....	..	..	2	<i>tenuicornis</i>	f	..	c
<i>bispinosa</i>.....	..	..	4	<i>Oithona attenuata</i>.....	..	..	f
<i>longimana</i>.....	..	..	5	<i>fallax</i>	a	..	f
<i>simplex</i>.....	..	..	4	<i>similis</i>.....	..	..	c
<i>Clausocalanus arcuicornis</i>	c	..	..	<i>spirostris</i>.....	..	..	f
<i>Corycaeus flaccus</i>.....	..	..	f	<i>Oncaea minuta</i>	c	..	a
<i>lautus</i>	f	..	..	<i>venusta</i>	c	..	a
<i>longistylis</i>	1	..	4	<i>Paracalanus parvus</i>.....	..	..	f
<i>pacificus</i>.....	..	..	5	<i>Pleuromamma gracilis</i>.....	..	..	3
<i>pumilus</i>	r	..	..	<i>Pseudocalanus minutus</i>	f	..	f
<i>typicus</i>	5	..	5	<i>Sapphirina auronitens</i>	1	..	..
<i>Euaetideus giesbrechti</i>.....	..	..	5	<i>metallina</i>.....	..	..	2
<i>Euchaeta acuta</i>.....	..	..	4	<i>Scolecithricella bradyi</i>.....	..	..	4
<i>Farranula carinata</i>	c	..	c	<i>Scolecithrix danae</i>.....	..	..	f
<i>rostrata</i>	c	..	c	<i>Undinula darwinii</i>	c	..	c
<i>Gaidius tenuispinus</i>.....	..	..	2				

The temperature was moderate and dropped less than 2° in 100 meters; the salinity and hydrogen-ion concentration were again fairly high and constant. Nineteen species were found at the surface and 41 in the 100-meter tow, yet the two tows had exactly the same length and volume. The 100-meter tow at this station, the 50-meter tows at stations 41 and 44, and the 1000-meter tow at station 64 were the only records for *Gaidius tenuispinus* in the eastern Pacific. It

evidently seeks a level below 100 meters during the daytime and is not abundant anywhere. The 4 *Candacia* species, 2 of the *Neocalanus* species, 3 of the *Oithona* species, and the single species of *Pleuromamma* were confined to the 100-meter tow, and none of them were abundant. Thirty species (66 per cent) appeared in one tow and not in the other, and 15 were common to both tows. Apparently the catch of the 50-meter tow was lost; no specimens were available.

STATION 67

January 8, 1929; 24° 57' S, 82° 15' W; bottom depth, 1089 m; 45 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	19.2	17.3	16.2	Density ($\sigma_{t,p}$)	24.9	25.4	25.8
Salinity, o/oo	34.9	34.7	34.6	Hydrogen-ion conc. (pH)	8.11	8.11	8.08
Volume of tow, cm ³	32	32	32	Length of tow, miles	0.3	0.3	0.3

<i>Acartia danac</i>	a	a	..	<i>Miracia efferata</i>.....	..	..	1
<i>negligens</i>	c	f	c	<i>Neocalanus gracilis</i>.....	..	..	c
<i>Acrocalanus gibber</i>.....	..	2	f	<i>robustior</i>.....	..	2	4
<i>gracilis</i>	c	c	f	<i>tenuicornis</i>.....	..	..	f
<i>Candacia truncata</i>.....	..	..	2	<i>Oithona attenuata</i>.....	..	3	f
<i>Clausocalanus arcuicornis</i>	f	f	c	<i>fallax</i>	2	..	c
<i>furcatus</i>	4	..	..	<i>setiger</i>.....	..	..	3
<i>Clytemnestra rostrata</i>.....	..	..	4	<i>similis</i>.....	..	f	c
<i>scutellata</i>.....	..	..	3	<i>spinirostris</i>.....	..	5	f
<i>Corycaeus agilis</i>	f	..	..	<i>Oncaea curta</i>	2	..	..
<i>crassiusculus</i>.....	..	2	..	<i>minuta</i>	3	f	..
<i>longistylis</i>.....	..	..	4	<i>venusta</i>	2	c	a
<i>ovalis</i>	2	..	..	<i>Paracalanus parvus</i>	f	f	f
<i>pacificus</i>.....	..	..	2	<i>Phaenna spinifera</i>.....	..	..	1
<i>typicus</i>.....	..	2	f	<i>Pleuromamma gracilis</i>.....	..	..	f
<i>Farranula carinata</i>	2	c	f	<i>Pontellina plumata</i>.....	..	..	1
<i>gibbula</i>	r	..	..	<i>Pseudocalanus minutus</i>.....	..	f	f
<i>rostrata</i>.....	..	f	c	<i>Sapphirina auronitens</i>.....	..	..	2
<i>Haloptilus longicornis</i>.....	..	..	1	<i>metallina</i>.....	..	..	1
<i>Lucicutia flavicornis</i>.....	..	2	f	<i>nigromaculata</i>.....	..	..	1
<i>Mecynocera clausi</i>.....	..	2	c	<i>Scolecithrix danae</i>.....	..	1	..
<i>Microcalanus pusillus</i>.....	..	1	..	<i>Undinula darwinii</i>.....	..	3	c
<i>Microsetella rosea</i>.....	..	..	2				

The temperature was moderate at the surface and fell 3° in the 100 meters, the salinity and hydrogen-ion concentration remaining constant. Fourteen species were present at the surface, 22 in the 50-meter tow, and 35 in the 100-meter tow. Twenty-five species (55 per cent) were each confined to a single tow and 6 were found in all three tows. *Corycaeus* and

Oithona presented many species, but comparatively few specimens, and this paucity in numbers was shared by nearly all the other genera, since only two of them were recorded as abundant. As at the two preceding stations, *Microsetella* was found only in the 100-meter tow, although it is usually a surface form.

STATION 68

January 10, 1929; 21° 28' S, 80° 26' W; bottom depth, 4156 m; 32 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	19.1	18.2	16.5	Density (σ_{tP})	25.0	25.4	25.9
Salinity, o/oo	35.1	35.0	34.8	Hydrogen-ion conc. (pH)	8.14	8.14	8.13
Volume of tow, cm ³	32	36	48	Length of tow, miles	0.9	1.0	1.0

<i>Acartia danae</i>	c	..	c	<i>Miracia efferata</i>.....	..	2	..
<i>negligens</i>	f	f	f	<i>Neocalanus gracilis</i>	1	4	4
<i>Acrocalanus gracilis</i>	2	..	4	<i>tenuicornis</i>.....	..	..	2
<i>Calanus propinquus</i>.....	..	..	1	<i>Oithona fallax</i>.....	..	..	f
<i>Calocalanus pavo</i>.....	..	..	2	<i>linearis</i>.....	..	..	2
<i>Canthocalanus pauper</i>.....	..	1	..	<i>setiger</i>.....	..	..	3
<i>Clausocalanus arcuicornis</i>	f	..	..	<i>similis</i>	1	f	..
<i>furcatus</i>	2	..	..	<i>spinirostris</i>.....	..	..	5
<i>Clytemnestra scutellata</i>.....	..	..	1	<i>Oncaea minuta</i>	3	f	c
<i>Eucalanus attenuatus</i>.....	..	..	2	<i>notopa</i>	1	..	..
<i>elongatus</i>.....	..	..	4	<i>venusta</i>.....	..	f	c
<i>Heterorhabdus papilliger</i>.....	..	..	2	<i>Paracalanus parvus</i>	1	2	..
<i>Lucicutia clausii</i>.....	..	..	2	<i>Pseudocalanus minutus</i>	1	..	..
<i>Mecynocera clausi</i>	a	a	a	<i>Sapphirina nigromaculata</i>.....	..	..	1
<i>Megacalanus longicornis</i>.....	..	5	2	<i>Scolecithricella porrecta</i>.....	..	..	2
<i>princeps</i>.....	..	2	..	<i>Undinula darwinii</i>.....	..	..	f

The temperature was rather low at the surface and dropped less than 3° in the 100 meters; the salinity and hydrogen-ion concentration were high and changed very little. Twelve species were captured at the surface, 11 in the 50-meter tow, and 23 in the 100-meter tow. Twenty-two species (70 per cent) were each restricted to a single tow and only 4 were found in all three tows. The single record for *Oithona linearis*

and one of very few for *Scolecithricella porrecta* were found in the 100-meter tow. This is one of the rare stations where none of the three tows contained a single specimen of any *Corycaeus* species. Again the *Oncaea* species were present at the surface but were not so abundant as in the deeper tows. Four of the 5 *Oithona* species were confined to the 100-meter tow.

STATION 69

January 12, 1929; 16° 49' S, 78° 39' W; bottom depth, 3657 m; 54 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	21.1	17.3	14.5	Density (σ_{tP})	24.6	25.7	26.4
Salinity, ‰	35.2	35.1	34.8	Hydrogen-ion conc. (pH)	8.12	7.99	7.86
Volume of tow, cm ³	48	32	64	Length of tow, miles	1.0	0.9	0.9

<i>Acartia danae</i>	c	f	c	<i>Lucicutia clausii</i>.....	..	1	1
<i>negligens</i>	c	..	..	<i>flavicornis</i>.....	..	..	2
<i>Acrocalanus gracilis</i>.....	..	4	2	<i>Macrosetella gracilis</i>.....	..	..	f
<i>monachus</i>.....	..	2	..	<i>Mecynocera clausi</i>.....	..	4	f
<i>Aetideus armatus</i>.....	..	..	1	<i>Metridia brevicauda</i>.....	..	..	2
<i>Calanus propinquus</i>	2	f	f	<i>lucens</i>.....	..	..	2
<i>Calocalanus plumulosus</i>.....	..	..	3	<i>Microsetella norvegica</i>.....	..	2	..
<i>Candacia simplex</i>	1	..	..	<i>rosea</i>.....	..	f	c
<i>Canthocalanus pauper</i>.....	..	2	..	<i>Neocalanus gracilis</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>.....	..	..	f	<i>Oithona attenuata</i>.....	..	f	f
<i>Clytemnestra rostrata</i>.....	..	..	2	<i>plumifera</i>	4	c	c
<i>Corycaeus crassiusculus</i>.....	..	f	a	<i>similis</i>	a	f	a
<i>pumilus</i>.....	..	..	r	<i>spinirostris</i>.....	..	2	..
<i>speciosus</i>.....	..	..	1	<i>Oithonina nana</i>.....	..	2	f
<i>typicus</i>.....	..	..	r	<i>Oncaea media</i>	f	..	..
<i>Eucalanus attenuatus</i>.....	..	a	c	<i>minuta</i>	c	f	a
<i>crassus</i>.....	..	f	f	<i>venusta</i>	c	a	a
<i>elongatus</i>	c	c	c	<i>Paracalanus parvus</i>	c	c	f
<i>Euchaeta marina</i>	f	4	r	<i>pygmaeus</i>.....	..	2	..
<i>Euchirella brevis</i>.....	..	2	..	<i>Phaenna spinifera</i>	1	..	..
<i>pulchra</i>.....	..	1	..	<i>Pleuromamma gracilis</i>.....	..	2	..
<i>Farranula carinata</i>	4	..	..	<i>Pseudocalanus minutus</i>	f	..	..
<i>gibbula</i>	f	..	..	<i>Sapphirina angusta</i>.....	..	..	1
<i>rostrata</i>.....	..	2	..	<i>auronitens</i>	1	1	1
<i>Haloptilus longicornis</i>.....	..	..	f	<i>nigromaculata</i>.....	..	1	2
<i>Heterorhabdus papilliger</i>.....	..	1	..	<i>Scolecithricella minor</i>.....	..	..	1
<i>spinifrons</i>.....	..	..	1	<i>Undinula darwinii</i>	f	..	..

The surface temperature was higher but it fell nearly 7° in the 100 meters; the salinity and hydrogen-ion concentration were high at the surface but diminished a little in the two lower depths. Eighteen species were present at the surface, 30 in the 50-meter tow, and 36 in the 100-meter tow. Thirty-four species (63 per cent) were each confined to a single tow and 10 were present in all three tows. Five species

alone were recorded as abundant, and nearly half of the records were numerals, 15 of them each a single specimen. *Aetideus*, *Haloptilus*, and *Metridia* were found only in the 100-meter tow, and the same was true of all but one of the *Corycaeus* species. On the other hand, each of the *Oncaea* species was present at the surface, but 2 of them were more abundant in the deeper tows.

STATION 70

January 13, 1929; 13° 53' S, 77° 54' W; bottom depth, 4742 m; 42 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	21.2	15.4	12.5	Density (σ_{tP})	24.5	25.8	26.3
Salinity, o/oo	35.0	34.9	34.7	Hydrogen-ion conc. (pH)	8.05	7.88	7.68
Volume of tow, cm ³	64	32	128	Length of tow, miles	1.0	1.2	1.2

<i>Acartia danae</i>.....	..	f	f	<i>Macrosetella gracilis</i>.....	..	..	3
<i>Acrocalanus gracilis</i>.....	..	2	r	<i>Mecynocera clausi</i>.....	..	..	2
<i>Aetideus armatus</i>.....	..	2	3	<i>Microsetella norvegica</i>.....	..	2	..
<i>Calanus propinquus</i>	a	a	a	<i>rosea</i>.....	..	f	f
<i>Calocalanus plumulosus</i>.....	..	..	1	<i>Neocalanus gracilis</i>.....	..	..	2
<i>Candacia norvegica</i>.....	..	..	1	<i>Oithona attenuata</i>.....	..	..	2
<i>pachydactyla</i>.....	..	..	1	<i>plumifera</i>.....	..	2	5
<i>Canthocalanus pauper</i>.....	..	1	..	<i>similis</i>	2	..	..
<i>Clytemnestra rostrata</i>.....	..	..	3	<i>Oithonina nana</i>	1	..	..
<i>scutellata</i>.....	..	..	1	<i>Oncaea curta</i>.....	..	..	r
<i>Corycaeus crassiusculus</i>	a	c	c	<i>media</i>	f	..	..
<i>pumilus</i>	r	..	..	<i>minuta</i>	5	f	f
<i>robustus</i>.....	..	..	r	<i>similis</i>.....	..	f	2
<i>speciosus</i>.....	..	..	2	<i>venusta</i>	c	a	a
<i>Eucalanus attenuatus</i>	2	c	a	<i>Paracalanus parvus</i>	c	a	..
<i>crassus</i>	1	c	a	<i>Pseudocalanus minutus</i>	1	f	3
<i>elongatus</i>.....	..	..	a	<i>Sapphirina angusta</i>.....	..	1	..
<i>Euchaeta marina</i>	f	f	f	<i>auronitens</i>.....	..	1	..
<i>Euchirella intermedia</i>.....	..	..	1	<i>nigromaculata</i>.....	..	1	..
<i>Haloptilus longicornis</i>.....	..	..	2	<i>opalina</i>.....	..	1	3
<i>oxycephalus</i>.....	..	..	1	<i>Scolecithricella minor</i>.....	..	..	1

The surface temperature was again high but dropped almost 9° (41 per cent) in the 100 meters; the salinity was high and constant; the hydrogen-ion concentration diminished in the two deeper tows. Thirteen species were recorded at the surface, 21 in the 50-meter tow, and 32 in the 100-meter tow. Twenty-six species (62 per cent) were each restricted to a single tow and 8 were present in all three tows. The *Eucalanus* species were especially abundant in the 100-

meter tow, and *Calanus* in all three tows, more especially at the surface. Numerals were again very much in evidence in the records, and 15 of them were single specimens. Two species of *Corycaeus* were present at the surface, 1 of them in abundance, but the other 2 species were found only in the deepest tow. *Oncaea* was well divided among the three tows. The 4 *Sapphirina* species were each represented by a single specimen taken in the 50-meter tow.

STATION 71

February 6, 1929; 11° 57' S, 78° 37' W; bottom depth, 3357 m; 40 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	23.4	16.7	13.9	Density (σ_{tP})	24.0	25.9	26.6
Salinity, o/oo	35.2	35.1	35.0	Hydrogen-ion conc. (pH)	8.13	7.90	7.72
Volume of tow, cm ³	160	32	32	Length of tow, miles	1.3	1.6	1.6

<i>Acartia danae</i>	c	c	f	<i>Haloptilus spiniceps</i>.....	..	1	..
<i>Calanus minor</i>.....	..	f	r	<i>Heterorhabdus papilliger</i>	1	..	..
<i>propinquus</i>	f	5	2	<i>Labidocera detruncata</i>	3	..	..
<i>Calocalanus plumulosus</i>	1	f	5	<i>Macrosetella gracilis</i>.....	..	f	1
<i>Candacia simplex</i>.....	..	1	..	<i>oculata</i>.....	..	1	..
<i>Clausocalanus arcuicornis</i>.....	..	..	f	<i>Mecynocera clausi</i>.....	..	f	f
<i>Clytemnestra rostrata</i>.....	..	..	3	<i>Microsetella rosea</i>	f	f	r
<i>scutellata</i>.....	..	..	1	<i>Oithona attenuata</i>	f	f	..
<i>Copilia denticulata</i>.....	..	1	..	<i>plumifera</i>	c	c	c
<i>quadrata</i>.....	..	..	2	<i>similis</i>	a	a	a
<i>Corycaeus crassiusculus</i>	f	f	a	<i>Oncaea media</i>.....	..	f	..
<i>longistylis</i>.....	..	..	1	<i>minuta</i>	c	c	a
<i>pacificus</i>.....	..	..	r	<i>venusta</i>	a	a	a
<i>pumilus</i>.....	..	..	f	<i>Paracalanus parvus</i>	c	f	c
<i>speciosus</i>	f	..	..	<i>Pleuromamma gracilis</i>.....	..	..	4
<i>Eucalanus attenuatus</i>	c	a	a	<i>Pseudocalanus minutus</i>	f	..	f
<i>crassus</i>	c	c	a	<i>Sapphirina angusta</i>	3	..	2
<i>elongatus</i>	c	c	a	<i>auronitens</i>	2	..	..
<i>monachus</i>.....	..	..	c	<i>scarlata</i>.....	..	1	1
<i>Euchaeta marina</i>	f	c	f	<i>Scolecithricella bradyi</i>.....	..	..	1

The temperature was again high at the surface but fell 9.5 in the 100 meters; the salinity remained high at all three depths, and the hydrogen-ion concentration diminished a little. Twenty-one species were present at the surface, 24 in the 50-meter tow, and 30 in the 100-meter tow. Nineteen species (47 per cent) were each confined to a single tow and 14

were found in all three tows. Three *Eucalanus* species, *Oithona similis*, and 2 *Oncaea* species were abundant or common in all three tows, and the percentage of numerals in the records was considerably reduced. Only a single specimen of *Heterorhabdus* was captured, and that was in the surface tow, contrary to the usual distribution.

STATION 72

February 8, 1929; 9° 58' S, 82° 10' W; bottom depth, 4480 m; 33 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	24.9	18.7	14.8	Density (σ_{tP})	23.6	25.6	26.5
Salinity, o/oo	35.3	35.3	35.0	Hydrogen-ion conc. (pH)	8.16	8.12	7.94
Volume of tow, cm ³	192	32	36	Length of tow, miles	1.1	2.3	2.3

<i>Acartia danae</i>.....	..	c	..	<i>Labidocera detruncata</i>	a	1	..
<i>Calanus minor</i>	r	c	2	<i>Lucicutia clausii</i>.....	..	..	2
<i>Calocalanus pavo</i>.....	..	1	1	<i>Macrosetella gracilis</i>.....	..	1	..
<i>plumulosus</i>.....	..	1	..	<i>oculata</i>.....	..	1	..
<i>Clytemnestra rostrata</i>.....	..	2	..	<i>Mecynocera clausi</i>.....	..	c	..
<i>scutellata</i>.....	..	3	..	<i>Microsetella rosea</i>.....	..	f	..
<i>Copilia denticulata</i>.....	..	1	..	<i>Oithona attenuata</i>.....	..	f	..
<i>Corycaeus crassiusculus</i>	f	f	..	<i>plumifera</i>.....	..	c	..
<i>pacificus</i>.....	..	f	..	<i>similis</i>	c	c	..
<i>speciosus</i>.....	..	f	..	<i>Oncaea minuta</i>.....	..	c	f
<i>typicus</i>	f	..	..	<i>venusta</i>	f	a	f
<i>Eucalanus attenuatus</i>.....	..	a	c	<i>Paracalanus parvus</i>	c	f	f
<i>crassus</i>	f	c	f	<i>pygmaeus</i>	2	..	..
<i>elongatus</i>.....	..	c	..	<i>Phaenna spinifera</i>.....	..	3	1
<i>monachus</i>.....	..	f	..	<i>Pseudocalanus minutus</i>	c	f	..
<i>Euchaeta marina</i>.....	..	f	r	<i>Sapphirina auronitens</i>.....	..	1	..
<i>Labidocera acutifrons</i>	f	..	..		

The high surface temperature dropped 10° in the 100 meters, the salinity remained high and constant, and the hydrogen-ion concentration diminished slightly in the two deeper tows. Eleven species were found at the surface, 29 in the 50-meter tow, and 10 in the 100-meter tow. Twenty species (61 per cent) were each restricted to a single tow and only 4 were present in all three tows. The length of the surface

tow was a trifle less than half that of the other two tows, but its volume was six times as great. Thus some constituents of the plankton found conditions more suitable at the surface than at the other depths. The copepods showed a decided preference for the 50-meter depth. At the surface *Labidocera* constituted over 90 per cent of the copepods, and in the 50-meter tow *Oncaea* was especially abundant.

BETWEEN STATIONS 72 AND 73

February 9, 1929; 10° 30' S, 84° 20' W; 16 species

<i>Acartia danae</i>	2	<i>Farranula rostrata</i>	1	<i>Oncaea venusta</i>	f
<i>Clausocalanus arcuicornis</i>	1	<i>Microsetella rosea</i>	1	<i>Paracalanus parvus</i>	a
<i>Corycaeus crassiusculus</i>	f	<i>Oithona similis</i>	c	<i>Pseudocalanus minutus</i>	a
<i>limbatus</i>	r	<i>spinirostris</i>	r	<i>Sapphirina auronitens</i>	1
<i>Euchaeta marina</i>	a	<i>Oncaea minuta</i>	f	<i>scarlata</i>	1
<i>Farranula carinata</i>	2				

Volume of tow, 48 cm³; length, 0.8 mile; surface only. This night-time tow must have been taken at an unfavorable hour (not recorded), since it yielded only 16 species. The single one that is at all noteworthy is the rare species *Sapphirina*

scarlata, which is also found at the surface in the daytime and hence cannot be regarded as a migrant from below. This tow consisted almost entirely of *Pseudocalanus*, *Euchaeta*, and *Paracalanus*, abundant in the order named.

STATION 73

February 10, 1929; 10° 46' S, 84° 57' W; bottom depth, 4670 m; 38 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	25.2	18.7	14.7	Density ($\sigma_{t\theta}$)	23.6	25.6	26.4
Salinity, ‰	35.4	35.3	34.9	Hydrogen-ion conc. (pH)	8.21	8.05	7.80
Volume of tow, cm ³	36	32	32	Length of tow, miles	0.5	0.6	0.6

<i>Acartia danae</i>.....	..	..	f	<i>Euchirella brevis</i>.....	..	..	1
<i>Calanus minor</i>.....	..	5	f	<i>curticauda</i>.....	..	..	1
<i>propinquus</i>.....	..	2	2	<i>Labidocera detruncata</i>	c	..	..
<i>Calocalanus pavo</i>.....	..	..	f	<i>Lucicutia flavicornis</i>.....	..	..	1
<i>plumulosus</i>.....	..	1	f	<i>longicornis</i>.....	..	..	2
<i>styliremis</i>.....	..	..	c	<i>Macrosetella gracilis</i>.....	..	..	2
<i>Clytemnestra scutellata</i>.....	..	2	..	<i>Mecynocera clausi</i>.....	..	..	f
<i>Copilia quadrata</i>.....	..	..	1	<i>Microsetella rosea</i>.....	..	1	f
<i>Corycaeus crassiusculus</i>	f	..	c	<i>Oithona attenuata</i>.....	..	4	f
<i>dubius</i>.....	..	3	..	<i>plumifera</i>.....	..	2	f
<i>furcifer</i>	1	..	..	<i>similis</i>.....	..	c	a
<i>pumilus</i>.....	..	..	f	<i>Oncaea curta</i>	r	..	..
<i>robustus</i>.....	..	..	1	<i>media</i>.....	..	r	..
<i>speciosus</i>.....	..	1	f	<i>minuta</i>.....	..	c	a
<i>Eucalanus attenuatus</i>.....	..	a	a	<i>venusta</i>	f	c	a
<i>crassus</i>.....	..	f	c	<i>Paracalanus parvus</i>	f	c	c
<i>elongatus</i>.....	..	f	f	<i>Pseudocalanus minutus</i>	c	c	c
<i>monachus</i>.....	..	f	c	<i>Sapphirina auronitens</i>.....	..	..	1
<i>Euchaeta marina</i>.....	..	..	f	<i>Temora discaudata</i>	2	..	..

The high surface temperature fell 10.5 in 100 meters. The salinity remained high and constant, and the hydrogen-ion concentration diminished slightly. Eight species were present at the surface, 19 in the 50-meter tow, and 31 in the 100-meter tow. Twenty species (52 per cent) were confined to a single tow and only 3 were present in all three tows. *Eucalanus*

was again conspicuous in the two deeper tows, but none of the 4 species appeared at the surface, and the same was true for the 3 species of *Oithona*. Although 1 species of *Oncaea* was restricted to the surface, the other 3 species were much more abundant in the deeper tows. *Euchirella* and *Lucicutia* were wholly confined to the 100-meter tow.

STATION 74

February 12, 1929; 11° 00' S, 87° 24' W; bottom depth, 4141 m; 52 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	24.2	19.2	15.4	Density (σ_{tP})	24.0	25.5	26.4
Salinity, o/oo	35.6	35.3	35.0	Hydrogen-ion conc. (pH)	8.17	8.06	7.88
Volume of tow, cm ³	64	32	96	Length of tow, miles	1.2	1.4	1.4

<i>Acartia danae</i>.....	..	f	..	<i>Haloptilus oxycephalus</i>.....	..	..	1
<i>Calanus minor</i>	f	f	c	<i>Heterorhabdus papilliger</i>.....	..	2	..
<i>propinquus</i>.....	..	3	c	<i>Labidocera detruncata</i>	f	..	..
<i>Calocalanus pavo</i>.....	..	1	..	<i>Lubbockia squillimana</i>.....	..	..	4
<i>plumulosus</i>.....	..	..	r	<i>Lucicutia clausii</i>.....	..	f	..
<i>styliremis</i>.....	..	5	f	<i>curta</i>.....	..	..	2
<i>Candacia simplex</i>	1	..	..	<i>flavicornis</i>.....	..	..	2
<i>Centropages calaninus</i>	5	..	..	<i>Mecynocera clausi</i>.....	..	f	f
<i>Clytemnestra rostrata</i>.....	..	..	1	<i>Microsetella rosea</i>.....	..	..	f
<i>scutellata</i>.....	..	..	2	<i>Oithona attenuata</i>.....	..	f	f
<i>Copilia quadrata</i>.....	..	..	1	<i>plumifera</i>.....	..	5	..
<i>vitrea</i>.....	..	1	..	<i>similis</i>	f	f	a
<i>Corycaeus crassiusculus</i>	a	2	f	<i>spinostris</i>	2	..	..
<i>giesbrechti</i>	r	..	..	<i>Oncaea minuta</i>	c	f	a
<i>longistylis</i>.....	..	f	..	<i>venusta</i>	c	f	a
<i>ovalis</i>	2	..	..	<i>Onchocalanus nudipes</i> , n. sp. ....	..	5	..
<i>pumilus</i>.....	..	r	..	<i>Paracalanus parvus</i>	c	f	f
<i>speciosus</i>	1	..	5	<i>Phaenna spinifera</i>	3	..	..
<i>Danodes plumata</i> , n. gen. and n. sp.	5 ♀	..	..	<i>Pleuromamma gracilis</i>.....	..	..	c
<i>Eucalanus attenuatus</i>.....	..	a	a	<i>Pseudocalanus minutus</i>	a	..	c
<i>crassus</i>.....	..	a	f	<i>Rhincalanus cornutus</i>.....	..	1	3
<i>elongatus</i>.....	..	a	f	<i>Sapphirina angusta</i>	1	..	5
<i>monachus</i>	1	..	..	<i>auronitens</i>	1	..	..
<i>Euchaeta marina</i>	r	f	f	<i>nigromaculata</i>.....	..	..	3
<i>Euchirella brevis</i>.....	..	..	3	<i>Temora discaudata</i>	2	..	2
<i>Haloptilus longicornis</i>.....	..	..	f	<i>Undinula vulgaris</i>	1	2	5

The temperature, salinity, and hydrogen-ion concentration were all high at the surface; the first fell 9° in the 100 meters and the other two diminished a little. Twenty-two species were taken at the surface, 25 in the 50-meter tow, and 33 in the 100-meter tow. Thirty-two species (61 per cent) were restricted to a single tow and 8 were found in all three tows. The *Eucalanus* species were again conspicuous in the two

deeper tows, but only a single specimen was found at the surface. Five specimens of the new *Onchocalanus* species were taken in the 50-meter tow, and 5 of the new genus *Danodes* at the surface. The *Corycaeus* and *Oncaea* species were well distributed in all three tows. *Haloptilus*, *Lubbockia*, and *Lucicutia* were all restricted to the 100-meter tow, which contains one of two records of *Lucicutia curta* for the cruise.

STATION 75

February 14, 1929; 14° 15' S, 92° 05' W; bottom depth, 3480 m; 56 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	22.7	20.0	17.8	Density (σ_{tP})	24.6	25.4	26.1
Salinity, o/oo	35.8	35.5	35.4	Hydrogen-ion conc. (pH)	8.18	8.14	8.06
Volume of tow, cm ³	48	32	48	Length of tow, miles	0.4	1.7	1.7

<i>Acartia danae</i>	2	f	f	<i>Lucicutia flavicornis</i>.....	..	..	f
<i>Calanus minor</i>.....	..	f	..	<i>Mecynocera clausi</i>.....	..	c	c
<i>propinquus</i>.....	..	f	f	<i>Microsetella norvegica</i>.....	..	..	2
<i>Calocalanus pavo</i>.....	..	2	3	<i>rosea</i>.....	..	f	f
<i>plumulosus</i>.....	..	c	..	<i>Neocalanus gracilis</i>.....	..	1	..
<i>styliremis</i>.....	..	f	..	<i>tenuicornis</i>.....	..	..	3
<i>Candacia bipinnata</i>.....	..	..	2	<i>Oithona attenuata</i>.....	..	..	f
<i>simplex</i>.....	..	2	4	<i>plumifera</i>.....	..	5	f
<i>Clytemnestra rostrata</i>.....	..	..	1	<i>similis</i>.....	..	c	c
<i>scutellata</i>.....	..	1	..	<i>spinirostris</i>.....	..	..	2
<i>Corycaeus crassiusculus</i>	f	f	..	<i>Oncaea media</i>	f	..	..
<i>longistylis</i>.....	..	1	1	<i>minuta</i>.....	..	f	c
<i>pacificus</i>.....	..	r	..	<i>venusta</i>	f	c	a
<i>pumilus</i>	r	..	..	<i>Onchocalanus nudipes, n. sp.</i>	5	..	..
<i>Eucalanus attenuatus</i>.....	..	a	a	<i>Paracalanus parvus</i>	c	c	..
<i>crassus</i>.....	..	f	f	<i>pygmaeus</i>.....	..	..	2
<i>elongatus</i>.....	..	a	c	<i>Phaenna spinifera</i>	2	..	..
<i>monachus</i>.....	..	r	f	<i>Pleuromamma gracilis</i>.....	..	..	f
<i>Euchaeta marina</i>.....	..	1	2	<i>Pontella lobiancoi</i>	c	..	..
<i>Euchirella brevis</i>.....	..	2	..	<i>securifer</i>	6	..	..
<i>Farranula carinata</i>.....	..	1	..	<i>Pseudocalanus minutus</i>	c	c	f
<i>rostrata</i>.....	..	..	2	<i>Rhincalanus cornutus</i>.....	..	..	1
<i>Haloptilus longicornis</i>.....	..	1	f	<i>Sapphirina auronitens</i>	1	..	..
<i>ornatus</i>.....	..	..	2	<i>nigromaculata</i>.....	..	f	..
<i>plumosus</i>.....	..	..	2	<i>opalina</i>.....	..	1	4
<i>Heterorhabdus papilliger</i>.....	..	..	1	<i>Temora discaudata</i>.....	..	a	a
<i>Lubbockia squillimana</i>.....	..	..	f	<i>Undinula darwinii</i>.....	..	2	..
<i>Lucicutia clausii</i>.....	..	..	f	<i>vulgaris</i>.....	..	2	5

Again the temperature, salinity, and hydrogen-ion concentration were high at the surface; the temperature decreased 5° and the other two diminished only slightly in the 100 meters. Twelve species were found at the surface, 33 in the 50-meter tow, and 38 in the 100-meter tow. Thirty-one species (55 per cent) were each confined to a single tow and only 3 were present in all three tows. Five specimens of the new *Onchocalanus* species were here taken at the surface and

none in the deeper tows. The 4 species of *Eucalanus* were again found in both the deeper tows but not at the surface. *Corycaeus* and *Oncaea* were distributed in all three tows, with the latter much more abundant in the two deeper tows. *Candacia*, *Haloptilus*, *Heterorhabdus*, and *Lucicutia* did not appear at the surface, and, contrary to the usual distribution, the same is true for *Farranula* and *Oithona*. *Temora* was very abundant at 50 meters and less so at 100 meters.

STATION 76

February 16, 1929; 15° 18' S, 97° 28' W; bottom depth, 3197 m; 19 species

Depth of tow, m	0	100	Depth of tow, m	0	100
Temperature, °C	23.4	21.2	Density (σ_{tP})	24.4	25.5
Salinity, o/oo	35.8	35.8	Hydrogen-ion concentration (pH)	8.15	8.13
Volume of tow, cm ³	32	36	Length of tow, miles	0.3	1.2

<i>Acartia danae</i>	f	2	<i>Microsetella rosea</i>	2	..
<i>negligens</i>	3	..	<i>Oithona attenuata</i>	f	..
<i>Aetideus armatus</i>.....	..	1	<i>similis</i>	c	f
<i>Calocalanus pavo</i>	c	..	<i>Oncaea minuta</i>	f	f
<i>Corycaeus longistylis</i>	1	..	<i>venusta</i>	f	c
<i>speciosus</i>.....	..	1	<i>Paracalanus parvus</i>	c	..
<i>Haloptilus ornatus</i>.....	..	1	<i>Pseudocalanus minutus</i>	c	..
<i>Lucicutia clausii</i>.....	..	2	<i>Temora discaudata</i>.....	..	c
<i>flavicornis</i>.....	..	3	<i>stylifera</i>	f	..
<i>Mecynocera clausi</i>	f	f			

The temperature was high at the surface and dropped only 2° in 100 meters; the salinity and hydrogen-ion concentration were high and remained constant. Thirteen species were taken at the surface and 11 in the 100-meter tow, the 50-

meter tow being lost. Fourteen species (70 per cent) were each confined to one tow and 5 appeared in both tows. *Aetideus*, *Haloptilus*, and *Lucicutia* appeared as usual only at 100 meters, *Paracalanus* and *Pseudocalanus* at the surface.

STATION 77

February 18, 1929; 14° 20' S, 103° 12' W; bottom depth, 4094 m; 27 species

<i>Acartia danae</i>	f	<i>Eucalanus attenuatus</i>	2	<i>Oithona plumifera</i>	f
<i>Calanus minor</i>	f	<i>Farranula carinata</i>	a	<i>similis</i>	f
<i>Calocalanus pavo</i>	f	<i>gibbula</i>	a	<i>Oncaea minuta</i>	f
<i>plumulosus</i>	1	<i>rostrata</i>	a	<i>venusta</i>	c
<i>Candacia simplex</i>	2	<i>Labidocera detruncata</i>	a	<i>Paracalanus parvus</i>	a
<i>Clausocalanus arcuicornis</i>	a	<i>Lucicutia longicornis</i>	2	<i>Pseudocalanus minutus</i>	a
<i>Corycaeus crassiusculus</i>	a	<i>Mecynocera clausi</i>	f	<i>Rhincalanus cornutus</i>	1
<i>longistylis</i>	a	<i>Microsetella rosea</i>	f	<i>Sapphirina auronitens</i>	1
<i>speciosus</i>	a	<i>Oithona attenuata</i>	2	<i>Temora discaudata</i>	f

We have at this station only the surface tow, which is noteworthy for its volume (144 cm³) in comparison with its length (0.3 mile). Temperature, 23.7; salinity, 36.0 o/oo; density, 24.5; hydrogen-ion concentration, 8.19. The number of species (27) is also well above the average for a surface tow, and 10 of them are recorded as abundant. The presence

of *Candacia*, *Eucalanus*, and *Rhincalanus* would suggest that something had delayed the usual downward migration, since these genera are usually found in the deeper tows in the daytime. *Clausocalanus*, *Corycaeus*, *Farranula*, and *Pseudocalanus* were each very abundant, whereas *Rhincalanus* and *Sapphirina* were each represented by a single specimen.

STATION 78

February 20, 1929; 13° 02' S, 108° 03' W; bottom depth, 3337 m; 41 species

Depth of tow, m	50	100	Depth of tow, m	50	100
Temperature, °C	23.8	21.9	Density (σ_{tP})	24.7	25.5
Salinity, o/oo	36.0	36.1	Hydrogen-ion concentration (pH)	8.14	8.14
Volume of tow, cm ³	80	32	Length of tow, miles	0.4	0.4

<i>Acartia danae</i>	c	f	<i>Mecynocera clausi</i>	a	a
<i>Acrocalanus gracilis</i>.....	..	f	<i>Microcalanus pygmaeus</i>	3	..
<i>Amalothrix propinqua</i>	1	..	<i>Microsetella rosea</i>	c	c
<i>Calanus minor</i>	f	..	<i>Neocalanus gracilis</i>.....	..	f
<i>Calocalanus pavo</i>.....	..	1	<i>robustior</i>.....	..	2
<i>plumulosus</i>	2	..	<i>Oithona attenuata</i>	a	a
<i>Candacia simplex</i>	c	..	<i>plumifera</i>	f	c
<i>Centropages calaninus</i>.....	..	2	<i>similis</i>	a	..
<i>Clausocalanus arcuicornis</i>.....	..	f	<i>spinirostris</i>.....	..	f
<i>Corycaeus crassiusculus</i>	a	c	<i>Oncaea minuta</i>	a	c
<i>flaccus</i>.....	..	f	<i>venusta</i>	a	..
<i>minimus</i>	r	..	<i>Paracalanus parvus</i>.....	..	c
<i>speciosus</i>.....	..	2	<i>pygmaeus</i>	c	..
<i>Euchirella messinensis</i>	1	..	<i>Pontellina plumata</i>	2	..
<i>Farranula carinata</i>	a	f	<i>Pseudocalanus minutus</i>.....	..	f
<i>gibbula</i>	2	..	<i>Rhincalanus cornutus</i>	a	a
<i>rostrata</i>	a	f	<i>Sapphirina auronitens</i>	3	4
<i>Haloptilus longicornis</i>	4	f	<i>nigromaculata</i>.....	..	2
<i>Heterorhabdus papilliger</i>.....	..	1	<i>Temora discaudata</i>.....	..	f
<i>Lucicutia flavicornis</i>	2	3	<i>longicornis</i>	1	..
<i>longicornis</i>.....	..	2			

The surface tow is lacking; the other two showed high temperature, salinity, and hydrogen-ion concentration, with little variation. Twenty-six species were taken in the 50-meter tow and 28 in the 100-meter tow. Twenty-eight species (70 per cent) were found in one tow and not in the other, and 13 were present in both tows. The 50-meter tow contains one of two Pacific records for *Corycaeus minimus* and 3 for *Temora longicornis*, and also has 2 other rare species, *Amallo-*

thrix propinqua and *Euchirella messinensis*. Of the four genera rated as very abundant at the surface in the record of station 77, only two appear here as abundant in the 50-meter tow. Conversely, *Rhincalanus*, of which there was but a single specimen there at the surface, is here abundant in both the deeper tows. *Farranula*, *Oncaea*, and *Mecynocera* are also especially abundant in the 50-meter tow, and *Oithona* in the 100-meter tow.

STATION 79

February 22, 1929; 12° 36' S, 112° 14' W; bottom depth, 3090 m; 35 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	25.1	24.5	21.8	Density (σ_{tP})	24.0	24.5	25.6
Salinity, ‰	35.9	36.0	36.1	Hydrogen-ion conc. (pH)	8.17	8.17	8.14
Volume of tow, cm ³	36	64	32	Length of tow, miles	0.2	0.8	0.8

Calanus minor.....	..	c	2	Mecynocera clausi.....	r	c	2
propinquus.....	..	f	..	Microsetella norvegica.....	..	2	..
Calocalanus pavo.....	..	2	..	rosea.....	..	f	2
Candacia simplex.....	..	f	..	Neocalanus gracilis.....	..	f	..
Corycaeus crassiusculus.....	f	f	1	robustior.....	..	f	..
dubius.....	..	r	..	Oithona plumifera.....	..	f	..
longistylis.....	..	2	..	Oncaea minuta.....	..	f	f
speciosus.....	..	..	2	venusta.....	r	..	f
Eucalanus elongatus.....	..	2	..	Paracalanus parvus.....	r	f	f
Euchirella pulchra.....	..	1	..	Pontellina plumata.....	..	2	..
Farranula carinata.....	..	f	..	Pseudocalanus minutus.....	r	f	..
rostrata.....	r	f	..	Rhincalanus cornutus.....	..	a	..
Haloptilus longicornis.....	..	1	..	Scolecithricella bradyi.....	..	..	1
Heterorhabdus papilliger.....	1	1	..	Scolecithrix danae.....	..	1	..
Labidocera detruncata.....	r	1	..	Undinula caroli.....	..	c	1
Lubbockia squillimana.....	..	2	1	darwinii.....	..	r	..
Lucicutia clausii.....	..	3	1	vulgaris.....	..	r	..
flavicornis.....	..	..	2				

The temperature, salinity, and hydrogen-ion concentration were all high and showed comparatively little variation. Eight species appeared at the surface, 31 in the 50-meter tow, and 13 in the 100-meter tow. Twenty-one species (60 per cent) were each confined to a single tow and only 3 were present in all three tows. The 50-meter tow was twice the volume of the 100-meter tow and very little less than twice the volume of the surface tow, and contained four times as

many species as the surface tow and more than twice as many as the 100-meter tow. Only 1 of its species, however, is recorded as abundant, and 3 as common; each of the others was limited to a few individuals. In addition to being limited to 8 species, the surface tow contained very few individuals. Similarly, 5 species in the deepest tow were represented by single specimens and 5 others by 2 specimens apiece, and the remaining 3 species were recorded as "few."

STATION 80

February 24, 1929; 12° 39' S, 117° 22' W; bottom depth, 3515 m; 54 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	26.0	25.9	Density ($\sigma_{t,p}$)	23.7	24.0
Salinity, o/oo	35.9	35.9	Hydrogen-ion concentration (pH)	8.20	8.19
Volume of tow, cm ³	64	96	Length of tow, miles	0.4	1.0

<i>Acartia danae</i>	f	f	<i>Farranula carinata</i>	c	c
<i>Acrocalanus gracilis</i>	c	..	<i>rostrata</i>	a	c
<i>monachus</i>	f	f	<i>Haloptilus acutifrons</i>.....	..	1
<i>Calanus minor</i>	f	f	<i>Labidocera detruncata</i>	a	f
<i>Calocalanus pavo</i>.....	..	2	<i>Lubbockia squillimana</i>.....	..	f
<i>Candacia aethiopica</i>	f	..	<i>Lucicutia clausii</i>	2	..
<i>bispinosa</i>.....	..	c	<i>Mecynocera clausi</i>.....	..	c
<i>norvegica</i>	2	5	<i>Microcalanus pusillus</i>.....	..	3
<i>simplex</i>	a	a	<i>Microsetella rosea</i>	f	a
<i>truncata</i>.....	..	f	<i>Oithona attenuata</i>.....	..	f
<i>Centropages calaninus</i>	4	..	<i>plumifera</i>.....	..	f
<i>Clausocalanus arcuicornis</i>	c	c	<i>similis</i>	c	f
<i>Clytemnestra rostrata</i>.....	..	1	<i>Oncaea curta</i>.....	..	2
<i>scutellata</i>.....	..	4	<i>media</i>.....	..	f
<i>Corycaeus agilis</i>	f	..	<i>minuta</i>	a	c
<i>catus</i>.....	..	2	<i>venusta</i>	a	c
<i>crassiusculus</i>	a	a	<i>Paracalanus parvus</i>	a	c
<i>longistylis</i>	c	c	<i>pygmaeus</i>	f	..
<i>speciosus</i>	f	f	<i>Pseudocalanus minutus</i>	a	c
<i>typicus</i>.....	..	1	<i>Rhincalanus cornutus</i>.....	..	a
<i>Eucalanus attenuatus</i>.....	..	c	<i>Sapphirina auronitens</i>	4	..
<i>crassus</i>.....	..	4	<i>nigromaculata</i>	2	..
<i>elongatus</i>.....	..	c	<i>Scolecithrix danae</i>.....	..	2
<i>Euchaeta acuta</i>	1	..	<i>Temora discaudata</i>	f	..
<i>marina</i>.....	..	5	<i>stylifera</i>	4	4
<i>Euchirella curticauda</i>.....	..	2	<i>Undinula caroli</i>	f	f
<i>pulchra</i>.....	..	1	<i>darwinii</i>	f	..

We have here high temperature, salinity, and hydrogen-ion concentration in both tows, with practically no variation. Thirty-one species were taken at the surface and 43 in the 50-meter tow. Thirty-four species (63 per cent) were present in one tow but wholly absent from the other, and 20 were taken in both tows. The 3 *Eucalanus* species, the 2 *Euchirella*

species, *Haloptilus*, and *Rhincalanus* did not appear at the surface; the *Candacia*, *Corycaeus*, *Farranula*, *Labidocera*, *Oncaea*, and *Undinula* species were well divided between the two tows. The 50-meter tow was two and a half times the length of the surface tow and its volume was one and a half times as great.

STATION 81

February 26, 1929; 13° 03' S, 121° 12' W; bottom depth, 2953 m; 47 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	26.5	26.4	Density (σ_{tP})	23.5	23.8
Salinity, o/oo	35.8	35.8	Hydrogen-ion concentration (pH)	8.19	8.19
Volume of tow, cm ³	48	96	Length of tow, miles	0.2	0.7

<i>Acartia danae</i>	2	c	<i>Labidocera detruncata</i>	a	f
<i>Acrocalanus gracilis</i>	c	f	<i>Lubbockia squillimana</i>.....	..	c
<i>Calanus minor</i>.....	..	f	<i>Mecynocera clausi</i>.....	..	f
<i>Calocalanus pavo</i>	1	r	<i>Megacalanus princeps</i>.....	..	f
<i>Candacia bispinosa</i>.....	..	c	<i>Microcalanus pusillus</i>.....	..	f
<i>norvegica</i>.....	..	f	<i>pygmaeus</i>	f	f
<i>simplex</i>	a	a	<i>Microsetella rosea</i>	f	f
<i>truncata</i>.....	..	c	<i>Neocalanus robustior</i>.....	..	f
<i>Clausocalanus arcuicornis</i>	c	..	<i>Oithona attenuata</i>	f	r
<i>Corycaeus crassiusculus</i>	a	a	<i>plumifera</i>.....	..	f
<i>dubius</i>	r	..	<i>similis</i>	f	..
<i>limbatus</i>.....	..	r	<i>Oncaea curta</i>	r	..
<i>longistylis</i>	c	..	<i>minuta</i>	f	c
<i>speciosus</i>	c	..	<i>similis</i>.....	..	2
<i>Eucalanus attenuatus</i>.....	..	c	<i>venusta</i>	c	..
<i>crassus</i>.....	..	f	<i>Paracalanus parvus</i>	c	c
<i>elongatus</i>.....	..	f	<i>pygmaeus</i>.....	..	f
<i>Euchaeta marina</i>.....	..	f	<i>Pseudocalanus minutus</i>	c	c
<i>Euchirella curticauda</i>.....	..	5	<i>Rhincalanus cornutus</i>.....	..	a
<i>Farranula carinata</i>	c	f	<i>Sapphirina auronitens</i>	1	1
<i>gibbula</i>	f	..	<i>Scolecithrix danae</i>.....	..	f
<i>rostrata</i>	a	f	<i>Undinula caroli</i>.....	..	c
<i>Haloptilus longicornis</i>.....	..	1	<i>darwinii</i>.....	..	f
<i>Heterorhabdus papilliger</i>.....	..	5			

The temperature, salinity, and hydrogen-ion concentration were high and did not change in the 50 meters. Twenty-three species appeared at the surface and 39 in the 50-meter tow. Thirty-two species (70 per cent) each were present in one tow and not in the other, and 15 were found in both tows. Again the *Eucalanus* species, *Euchirella*, *Heterorhabdus*, *Lubbockia*,

Megacalanus, and *Rhincalanus* were confined to the deeper tow, and *Corycaeus*, *Farranula*, *Oithona*, and *Oncaea* were well divided between the two tows. One species of *Candacia* was abundant in both tows; the other 3 species did not appear at all at the surface. *Clausocalanus* was found only at the surface.

STATION 82

February 28, 1929; 14° 52' S, 126° 07' W; bottom depth, 3631 m; 52 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	27.2	27.2	Density (σ_{tP})	23.6	24.0
Salinity, o/oo	36.3	36.3	Hydrogen-ion concentration (pH)	8.21	8.21
Volume of tow, cm ³	32	64	Length of tow, miles	0.4	1.8

<i>Acartia danae</i>	r	f	<i>Lubbockia squillimana</i>.....	..	f
<i>Acrocalanus gracilis</i>	f	f	<i>Lucicutia flavicornis</i>	1	2
<i>monachus</i>.....	..	5	<i>Mecynocera clausi</i>.....	..	f
<i>Calanus minor</i>.....	..	c	<i>Megacalanus longicornis</i>.....	..	c
<i>Calocalanus pavo</i>.....	..	f	<i>Microcalanus pusillus</i>.....	..	1
<i>styliremis</i>.....	..	r	<i>pygmaeus</i>.....	..	f
<i>Candacia bispinosa</i>.....	..	f	<i>Microsetella rosea</i>	r	c
<i>norvegica</i>	1	f	<i>Neocalanus robustior</i>.....	..	f
<i>simplex</i>.....	..	a	<i>Oithona attenuata</i>	r	f
<i>truncata</i>.....	..	f	<i>plumifera</i>	2	4
<i>Centropages calaninus</i>.....	..	2	<i>similis</i>	f	f
<i>Copilia quadrata</i>	1	..	<i>Oncaea conifera</i>.....	..	2
<i>Corycaeus crassiusculus</i>	f	c	<i>minuta</i>	f	c
<i>longistylis</i>	c	c	<i>venusta</i>	f	a
<i>speciosus</i>	c	c	<i>Pachos punctatum</i>.....	..	2
<i>typicus</i>.....	..	f	<i>Paracalanus parvus</i>	f	c
<i>Eucalanus attenuatus</i>.....	..	c	<i>Pontellina plumata</i>.....	..	5
<i>crassus</i>.....	..	f	<i>Pseudocalanus minutus</i>.....	..	c
<i>Euchaeta acuta</i>.....	..	1	<i>Rhincalanus cornutus</i>.....	..	f
<i>marina</i>.....	..	f	<i>nasutus</i>.....	..	f
<i>Euchirella pulchra</i>.....	..	2	<i>Sapphirina auronitens</i>.....	..	1
<i>Farranula carinata</i>	a	c	<i>metallina</i>.....	..	1
<i>curta</i>.....	..	f	<i>Scolecithrix danae</i>.....	..	a
<i>gibbula</i>	c	..	<i>Temora discaudata</i>.....	..	3
<i>rostrata</i>	a	c	<i>Undeuchaeta plumosa</i>	1	..
<i>Labidocera detruncata</i>	f	..	<i>Undinula darwinii</i>.....	..	f

Again the temperature, salinity, and hydrogen-ion concentration were high and did not change. Twenty species were found in the surface tow and 48 in the 50-meter net. Thirty-six species (70 per cent) were present in one tow and not in the other, and 16 species were found in both tows. The 50-meter tow was four and a half times as long as the surface tow but had only twice the volume. The same genera as at

station 81, together with many others, were confined to the deeper tow, and the same genera were divided between the two tows. Only a single specimen of *Candacia* was present at the surface, all the others of the 4 species of this genus appearing only in the 50-meter tow. Contrary to expectation, the single specimen of *Undeuchaeta* was found at the surface rather than in the deeper tow.

STATION 83

March 2, 1929; 17° 00' S, 129° 45' W; bottom depth, 3966 m; 31 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	27.5	27.4	Density (σ_{tP})	23.5	23.9
Salinity, o/oo	36.2	36.4	Hydrogen-ion concentration (pH)	8.24	8.24
Volume of tow, cm ³	32	64	Length of tow, miles	0.1	0.3

<i>Acartia danae</i>.....	..	f	<i>Macrosetella gracilis</i>.....	..	1
<i>Acrocalanus gracilis</i>.....	..	r	<i>Mecynocera clausi</i>.....	..	f
<i>Calocalanus pavo</i>	2	..	<i>Megacalanus longicornis</i>.....	..	a
<i>Candacia simplex</i>.....	..	c	<i>Microcalanus pygmaeus</i>.....	..	2
<i>Centropages calaninus</i>.....	..	2	<i>Microsetella rosea</i>	1	r
<i>Copilia quadrata</i>.....	..	3	<i>Neocalanus gracilis</i>.....	..	2
<i>Corycaeus crassiusculus</i>	f	c	<i>robustior</i>.....	..	f
<i>dubius</i>	f	..	<i>Oithona attenuata</i>.....	..	c
<i>pacificus</i>.....	..	f	<i>similis</i>	2	a
<i>speciosus</i>	f	2	<i>spinostris</i>.....	..	a
<i>Euchaeta acuta</i>.....	..	r	<i>Oncaea venusta</i>.....	..	c
<i>marina</i>	1	c	<i>Paracalanus parvus</i>.....	..	c
<i>Euchirella curticauda</i>.....	..	2	<i>Pontellina plumata</i>.....	..	1
<i>Farranula carinata</i>	a	a	<i>Pseudocalanus minutus</i>	4	f
<i>rostrata</i>	a	..	<i>Scolecithrix danae</i>.....	..	f
<i>Labidocera detruncata</i>	c	..			

The temperature, salinity, and hydrogen-ion concentration were all high and practically unchanged at the two depths. Eleven species appeared at the surface and 27 species in the 50-meter tow. Twenty-four species (75 per cent) were found in one tow and not in the other, and 7 species were present in both tows. *Euchirella* and *Megacalanus* were found only

in the deeper tow; the other four deep-water genera did not occur at all in this locality. *Corycaeus* and *Farranula* were divided as before between the two tows, and the 2 species of *Farranula* constituted a large percentage of the surface tow, but *Oithona*, except for 2 specimens, and *Oncaea* were not present at the surface.

STATION 84

March 4, 1929; 17° 11' S, 133° 18' W; bottom depth, 4121 m; 37 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	27.8	27.5	Density (σ_{tP})	23.3	23.8
Salinity, o/oo	36.2	36.4	Hydrogen-ion concentration (pH)	8.23	8.21
Volume of tow, cm ³	32	64	Length of tow, miles	0.1	0.5

<i>Acartia danae</i>	f	c	<i>Farranula rostrata</i>	c	a
<i>Acrocalanus gracilis</i>.....	..	f	<i>Labidocera detruncata</i>	1	..
<i>Calocalanus pavo</i>	2	2	<i>Lubbockia squillimana</i>.....	..	f
<i>styliremis</i>	1	..	<i>Lucicutia flavicornis</i>.....	..	1
<i>Candacia bispinosa</i>.....	..	c	<i>Mecynocera clausi</i>.....	..	f
<i>simplex</i>.....	..	a	<i>Megacalanus longicornis</i>.....	..	2
<i>Centropages calaninus</i>.....	..	c	<i>Microcalanus pygmaeus</i>.....	..	f
<i>Clausocalanus arcuicornis</i>.....	..	f	<i>Microsetella rosea</i>.....	..	f
<i>Copilia vitrea</i>.....	..	2	<i>Neocalanus gracilis</i>.....	..	2
<i>Corycaeus crassiusculus</i>	a	a	<i>Oithona attenuata</i>.....	..	c
<i>flaccus</i>.....	..	r	<i>similis</i>.....	..	a
<i>longistylis</i>.....	..	4	<i>Oncaea curta</i>	f	..
<i>pumilus</i>.....	..	3	<i>minuta</i>.....	..	f
<i>speciosus</i>	f	..	<i>venusta</i>.....	..	c
<i>Eucalanus attenuatus</i>.....	..	1	<i>Paracalanus pygmaeus</i>.....	..	f
<i>Euchaeta acuta</i>.....	..	5	<i>Pontellina plumata</i>	1	3
<i>marina</i>.....	..	a	<i>Pseudocalanus minutus</i>	1	..
<i>Farranula carinata</i>	a	a	<i>Scolecithrix danae</i>.....	..	a
<i>gibbula</i>	f	..			

The temperature, salinity, and hydrogen-ion concentration were all high and changed very little. Twelve species were found at the surface and 31 in the 50-meter tow. Thirty-one species (84 per cent) were present in one tow and not in the

other, and 6 were found in both tows. *Corycaeus*, *Oithona*, and *Oncaea* were much more abundant in the deeper tow; *Farranula* was divided between the two tows, but more abundant at the surface, where it formed a large percentage of the total.

STATION 85

March 6, 1929; 17° 12' S, 136° 37' W; bottom depth, 3791 m; 35 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	27.9	27.8	Density (σ_{tP})	23.3	23.5
Salinity, o/oo	36.2	36.2	Hydrogen-ion concentration (pH)	8.22	8.22
Volume of tow, cm ³	36	64	Length of tow, miles	0.1	0.4

<i>Acartia danae</i>.....	..	c	<i>Microcalanus pygmaeus</i>.....	..	f
<i>Acrocalanus gracilis</i>	1	..	<i>Microsetella rosea</i>	1	f
<i>monachus</i>.....	..	f	<i>Neocalanus gracilis</i>.....	..	f
<i>Calanus minor</i>.....	..	f	<i>robustior</i>.....	..	c
<i>Candacia bispinosa</i>.....	..	a	<i>Oithona attenuata</i>.....	..	c
<i>simplex</i>.....	..	a	<i>similis</i>.....	..	c
<i>Copilia denticulata</i>.....	..	1	<i>spirostris</i>.....	..	c
<i>Corycaeus crassiusculus</i>	r	c	<i>Oncaea minuta</i>.....	..	c
<i>dubius</i>	2	..	<i>Paracalanus parvus</i>.....	..	f
<i>speciosus</i>.....	..	c	<i>Phaenna spinifera</i>.....	..	f
<i>Eucalanus attenuatus</i>.....	..	f	<i>Pleuromamma gracilis</i>.....	..	1
<i>elongatus</i>.....	..	f	<i>Pontellina plumata</i>.....	..	5
<i>Euchaeta marina</i>.....	..	a	<i>Pseudocalanus minutus</i>.....	..	c
<i>Euchirella curticauda</i>.....	..	3	<i>Sapphirina angusta</i>.....	..	1
<i>Farranula carinata</i>	a	a	<i>pyrosomatis</i>	1	..
<i>gibbula</i>	2	..	<i>Scolecithrix danae</i>.....	..	a
<i>rostrata</i>	a	r	<i>Undinula darwinii</i>.....	..	f
<i>Megacalanus longicornis</i>.....	..	a			

The temperature, salinity, and hydrogen-ion concentration were all high and unchanged at the two depths. Eight species were present at the surface and 31 in the 50-meter tow. Thirty-one species (90 per cent) were present in but one of the tows and only 4 were present in both tows. *Oithona* and

Oncaea were confined to the deeper tow, but *Corycaeus* and *Farranula* were divided between the two tows. *Candacia*, *Eucalanus*, and *Neocalanus*, with many others, were found only at 50 meters. The surface tow contained very few specimens besides the 2 species of *Farranula* recorded as abundant.

BETWEEN STATIONS 85 AND 86

March 8, 1929; 17° 48' S, 140° 49' W; 20 species

<i>Acartia danae</i>	c	<i>Corycaeus longistylis</i>	2	<i>Oncaea minuta</i>	f
<i>Acrocalanus gracilis</i>	1	<i>robustus</i>	2	<i>similis</i>	2
<i>Candacia norvegica</i>	5	<i>speciosus</i>	f	<i>venusta</i>	c
<i>simplex</i>	f	<i>Farranula carinata</i>	c	<i>Paracalanus parvus</i>	c
<i>Centropages calaninus</i>	f	<i>gibbula</i>	4	<i>Pseudocalanus minutus</i>	c
<i>Corycaeus agilis</i>	r	<i>rostrata</i>	c	<i>Sapphirina auronitens</i>	1
<i>crassiusculus</i>	c	<i>Microsetella rosea</i>	1		

Volume of tow, 32 cm³; length, 3 miles; surface only. In this nocturnal tow between stations, 20 copepod species were found, including many that were confined to the deeper tow

at the regular station on either side. None of the species was at all abundant, but 7 out of the 20 were recorded as common.

STATION 86

March 9, 1929; 17° 36' S, 141° 55' W; bottom depth, 2132 m; 35 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	28.2	27.4	Density (σ_{tP})	23.2	23.7
Salinity, o/oo	36.1	36.2	Hydrogen-ion concentration (pH)	8.29	8.29
Volume of tow, cm ³	32	34	Length of tow, miles	0.1	0.2

<i>Acartia danae</i>.....	..	c	<i>Lubbockia squillimana</i>.....	..	1
<i>Acrocalanus gracilis</i>.....	..	f	<i>Microsetella rosea</i>.....	..	f
<i>monachus</i>.....	..	f	<i>Neocalanus gracilis</i>.....	..	f
<i>Calocalanus styliremis</i>.....	..	2	<i>Oithona plumifera</i>.....	..	f
<i>Candacia simplex</i>.....	..	c	<i>similis</i>.....	..	c
<i>Centropages calaninus</i>.....	..	f	<i>spirostris</i>.....	..	f
<i>Clausocalanus arcuicornis</i>	1	..	<i>Oncaea media</i>.....	..	c
<i>Copilia denticulata</i>.....	..	4	<i>minuta</i>.....	..	c
<i>quadrata</i>.....	..	4	<i>venusta</i>.....	..	a
<i>Corycaeus crassiusculus</i>.....	..	c	<i>Paracalanus parvus</i>	2	c
<i>longistylis</i>.....	..	f	<i>Phaenna spinifera</i>.....	..	4
<i>speciosus</i>	1	f	<i>Pleuromamma gracilis</i>.....	..	c
<i>typicus</i>.....	..	r	<i>Pseudocalanus minutus</i>.....	..	c
<i>Euchaeta acuta</i>.....	..	f	<i>Sapphirina auronitens</i>.....	..	2
<i>marina</i>.....	..	a	<i>metallina</i>.....	..	1
<i>Farranula carinata</i>	c	c	<i>pyrosomatis</i>.....	..	1 ♀
<i>concinna</i>.....	..	1	<i>Scolecithrix danae</i>.....	..	f
<i>rostrata</i>	c	c			

Again the temperature, salinity, and hydrogen-ion concentration were high and almost the same for both depths. Only 5 species were found at the surface, and 34 in the 50-meter tow. Thirty-one species (90 per cent) appeared in one

tow and not in the other, and only 4 were common to both. The surface tow yielded but 4 specimens besides the 2 species of *Farranula*. The 50-meter tow contained a single female of *Sapphirina pyrosomatis*, found in only two other localities.

STATION 87

March 11, 1929; 18° 05' S, 145° 33' W; bottom depth, 4315 m; 33 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	27.8	26.5	Density (σ_{tP})	23.2	23.9
Salinity, o/oo	36.0	36.0	Hydrogen-ion concentration (pH)	8.28	8.26
Volume of tow, cm ³	34	64	Length of tow, miles	0.4	0.9

<i>Acartia danae</i>.....	..	c	<i>Microsetella rosea</i>.....	..	2
<i>Acrocalanus gracilis</i>.....	..	c	<i>Miracia efferata</i>.....	..	2
<i>Calanus minor</i>.....	..	c	<i>Neocalanus gracilis</i>.....	..	f
<i>Candacia simplex</i>	1	..	<i>robustior</i>.....	..	2
<i>Centropages calaninus</i>.....	..	1	<i>Oithona attenuata</i>.....	..	f
<i>Clausocalanus arcuicornis</i>.....	..	c	<i>similis</i>.....	..	f
<i>Corycaeus crassiusculus</i>	r	f	<i>spirostris</i>.....	..	c
<i>longistylis</i>	2	f	<i>Oncaea minuta</i>.....	..	f
<i>speciosus</i>	1	f	<i>venusta</i>.....	..	c
<i>typicus</i>.....	..	r	<i>Paracalanus parvus</i>	f	c
<i>Euchaeta acuta</i>.....	..	f	<i>pygmaeus</i>.....	..	f
<i>marina</i>.....	..	c	<i>Pleuromamma gracilis</i>.....	..	c
<i>Farranula carinata</i>	a	c	<i>Pseudocalanus minutus</i>	c	a
<i>gibbula</i>	f	..	<i>Scolecithrix danae</i>.....	..	c
<i>rostrata</i>.....	..	f	<i>Spinocalanus caudatus</i>.....	..	f
<i>Mecynocera clausi</i>.....	..	1	<i>magnus</i>.....	..	f
<i>Microcalanus pygmaeus</i>.....	..	c			

The temperature, salinity, and hydrogen-ion concentration were high and changed but little at the two depths. Eight species were found at the surface and 31 in the 50-meter tow. Twenty-seven species (89 per cent) were found at one depth

only and 6 at both depths. In the surface tow *Farranula carinata* exceeded in abundance all the other species combined, and in the 50-meter tow *Pseudocalanus minutus* was the most abundant single species.

STATION 88

March 21, 1929; 16° 42' S, 150° 41' W; bottom depth, 3697 m; 53 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	28.4	28.4	Density (σ_{tP})	22.9	23.2
Salinity, ‰	35.8	35.8	Hydrogen-ion concentration (pH)	8.23	8.25
Volume of tow, cm ³	34	96	Length of tow, miles	0.4	0.3

<i>Acartia danae</i>.....	..	c	<i>Farranula gibbula</i>	r	..
<i>Acrocalanus gracilis</i>	f	f	<i>rostrata</i>	c	..
<i>longicornis</i>	1	..	<i>Lubbockia squillimana</i>.....	..	4
<i>monachus</i>.....	..	f	<i>Mecynocera clausi</i>.....	..	1
<i>Amalothrix propinqua</i>	1	..	<i>Microcalanus pusillus</i>.....	..	f
<i>Calanus minor</i>.....	..	f	<i>pygmaeus</i>.....	..	c
<i>Calocalanus pavo</i>.....	..	2	<i>Microsetella rosea</i>.....	..	f
<i>styliremis</i>.....	..	2	<i>Oithona attenuata</i>.....	..	f
<i>Candacia bispinosa</i>.....	..	f	<i>plumifera</i>.....	..	f
<i>norvegica</i>.....	..	f	<i>similis</i>	2	f
<i>simplex</i>	1	c	<i>Oncaea curta</i>	3	..
<i>truncata</i>.....	..	4	<i>mediterranea</i>.....	..	2
<i>Centropages calaninus</i>.....	..	c	<i>minuta</i>	r	f
<i>Clausocalanus arcuicornis</i>.....	..	c	<i>similis</i>.....	..	4
<i>Clytemnestra rostrata</i>.....	..	1	<i>venusta</i>.....	..	c
<i>Copilia denticulata</i>.....	..	f	<i>Pachos punctatum</i>	3	..
<i>quadrata</i>.....	..	2	<i>Paracalanus parvus</i>	c	a
<i>Corycaeus agilis</i>	r	..	<i>Pontellina plumata</i>.....	..	1
<i>crassiusculus</i>	r	a	<i>Pseudocalanus minutus</i>.....	..	c
<i>flaccus</i>	1	..	<i>Sapphirina auronitens</i>	2	1
<i>longistylis</i>.....	..	f	<i>nigromaculata</i>.....	..	2
<i>pumilus</i>.....	..	r	<i>opalina</i>.....	..	3
<i>speciosus</i>.....	..	c	<i>Scolecithrix danae</i>.....	..	a
<i>typicus</i>.....	..	2	<i>Undeuchaeta plumosa</i>	1	..
<i>Euchaeta acuta</i>.....	..	3	<i>Undinula darwinii</i>.....	..	1
<i>marina</i>.....	..	c	<i>vulgaris</i>.....	..	4
<i>Farranula carinata</i>	a	f			

The temperature, salinity, and hydrogen-ion concentration were high and the first two were exactly and the last practically the same at both depths. Seventeen species were found at the surface and 44 in the 50-meter tow. Forty-five species (85 per cent) were present in one tow but not in the

other; 8 species were found in both tows. *Corycaeus* and *Oithona* were much more abundant in the deeper tow; *Farranula* constituted a large percentage of the surface tow. Although the 50-meter tow was a little shorter than the surface tow, its volume was nearly three times as large.

STATION 89

March 23, 1929; 17° 09' S, 152° 41' W; bottom depth, 4286 m; 49 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	28.3	28.3	Density (σ_{tP})	22.7	23.1
Salinity, o/oo	35.6	35.8	Hydrogen-ion concentration (pH)	8.25	8.27
Volume of tow, cm ³	34	64	Length of tow, miles	0.3	0.5

<i>Acartia danae</i>.....	..	f	<i>Lubbockia squillimana</i>.....	..	f
<i>Acrocalanus gracilis</i>	a	f	<i>Macrosetella gracilis</i>	f	1
<i>monachus</i>.....	..	f	<i>Microcalanus pusillus</i>.....	..	f
<i>Calanus minor</i>.....	..	f	<i>Microsetella rosea</i>	1	c
<i>Calocalanus pavo</i>.....	..	1	<i>Neocalanus gracilis</i>.....	..	4
<i>Candacia bispinosa</i>.....	..	2	<i>robustior</i>.....	..	2
<i>simplex</i>	2	a	<i>Oithona attenuata</i>.....	..	f
<i>truncata</i>.....	..	f	<i>plumifera</i>.....	..	c
<i>Centropages calaninus</i>	2	f	<i>similis</i>	a	c
<i>Clausocalanus arcuicornis</i>	f	f	<i>spirostris</i>.....	..	3
<i>Clytemnestra scutellata</i>.....	..	4	<i>Oithona nana</i>	c	..
<i>Copilia denticulata</i>.....	..	c	<i>Oncaea curta</i>	r	..
<i>quadrata</i>.....	..	2	<i>media</i>	f	f
<i>vitrea</i>.....	..	1	<i>minuta</i>	c	f
<i>Corycaeus crassiusculus</i>	c	2	<i>venusta</i>	f	c
<i>dubius</i>	r	..	<i>Onchocalanus nudipes, n. sp.</i>	2	..
<i>typicus</i>	2	..	<i>Paracalanus parvus</i>.....	..	c
<i>Euchaeta acuta</i>.....	..	f	<i>Pontellina plumata</i>.....	..	2
<i>marina</i>	2	a	<i>Sapphirina auronitens</i>	1	..
<i>Euchirella brevis</i>.....	..	1	<i>opalina</i>.....	..	2
<i>curticauda</i>.....	..	1	<i>Scolecithrix danae</i>	1	a
<i>Farranula carinata</i>	a	f	<i>Spinocalanus abyssalis</i>.....	..	3
<i>gibbula</i>	r	..	<i>magnus</i>.....	..	1
<i>rostrata</i>	f	f	<i>Undinula vulgaris</i>.....	..	f
<i>Labidocera detruncata</i>	2	..			

The temperature was high and exactly the same at both depths; the salinity and hydrogen-ion concentration increased slightly at the lower depth. Twenty-three species were found at the surface and 41 in the 50-meter tow. Thirty-four species (70 per cent) were found in one tow and not in the other, and

15 were common to both tows. *Corycaeus*, *Farranula*, and *Oncaea* were more abundant at the surface, but 3 of the 4 *Oithona* species did not appear at all in the surface tow. The 2 *Euchaeta* species were recorded as constituting 75 per cent of the 50-meter tow.

BETWEEN STATIONS 89 AND 90

March 23, 1929; 17° 04' S, 152° 58' W; 46 species

<i>Acartia danae</i>	c	<i>Corycaeus furcifer</i>	r	<i>Macrosetella oculata</i>	2
<i>negligens</i>	3	<i>longistylis</i>	3	<i>Microcalanus pygmaeus</i>	c
<i>Acrocalanus gracilis</i>	c	<i>pacificus</i>	4	<i>Microsetella norvegica</i>	1
<i>monachus</i>	f	<i>pumilus</i>	1	<i>rosea</i>	f
<i>Calanus minor</i>	f	<i>speciosus</i>	f	<i>Neocalanus robustior</i>	f
<i>Calocalanus pavo</i>	1	<i>Euchaeta acuta</i>	2	<i>Oncaea curta</i>	2
<i>plumulosus</i>	1	<i>marina</i>	c	<i>media</i>	f
<i>Candacia aethiopica</i>	3	<i>Euchirella brevis</i>	1	<i>minuta</i>	a
<i>bispinosa</i>	f	<i>Farranula carinata</i>	a	<i>venusta</i>	a
<i>norvegica</i>	f	<i>gibbula</i>	f	<i>Paracalanus parvus</i>	c
<i>simplex</i>	c	<i>rostrata</i>	c	<i>Pontella securifer</i>	1
<i>Canthocalanus pauper</i>	2	<i>Labidocera detruncata</i>	f	<i>Pontellina plumata</i>	f
<i>Centropages calaninus</i>	c	<i>Lucicutia clausii</i>	1	<i>Sapphirina auronitens</i>	f
<i>Clytemnestra rostrata</i>	5	<i>Macrosetella gracilis</i>	a	<i>Spinocalanus magnus</i>	2
<i>Corycaeus catus</i>	r			<i>Undinula vulgaris</i>	f
<i>crassiusculus</i>	a				

Volume of tow, 48 cm³; length, 0.1 mile; time, 7^h 50^m to 10^h P.M.; surface only. This nocturnal tow yielded 46 species, about as many as were obtained in both tows at each of stations 89 and 90. Nineteen species which were confined to the 50-meter tow at stations 89 and 90, one or both, were

here found at the surface. In addition, 13 species were here present at the surface at night which did not appear in the daytime tows at stations 89 and 90. Thirty of the species, therefore, give good evidence of nocturnal migration. *Corycaeus*, *Farranula*, and *Oncaea* were especially abundant.

STATION 90

March 25, 1929; 16° 35' S, 155° 45' W; bottom depth, 4630 m; 45 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	28.5	28.6	Density (σ_{tP})	22.6	22.9
Salinity, o/oo	35.4	35.6	Hydrogen-ion concentration (pH)	8.27	8.26
Volume of tow, cm ³	34	80	Length of tow, miles	0.6	0.9

<i>Acartia danae</i>.....	..	c	<i>Farranula rostrata</i>	f	c
<i>Acrocalanus gracilis</i>	f	c	<i>Labidocera detruncata</i>	f	..
<i>monachus</i>	f	a	<i>Macrosetella gracilis</i>.....	..	1
<i>Calanus minor</i>.....	..	f	<i>Mecynocera clausi</i>	2	..
<i>propinquus</i>.....	..	1	<i>Microcalanus pygmaeus</i>.....	..	a
<i>Candacia bispinosa</i>.....	..	f	<i>Microsetella norvegica</i>.....	..	2
<i>simplex</i>.....	..	f	<i>rosea</i>.....	..	f
<i>Centropages calaninus</i>.....	..	f	<i>Oithona attenuata</i>.....	..	f
<i>Clausocalanus arcuicornis</i>	1	f	<i>plumifera</i>.....	..	f
<i>Copilia denticulata</i>	f	c	<i>similis</i>	f	..
<i>quadrata</i>	1	..	<i>spinirostris</i>.....	..	2
<i>vitrea</i>.....	..	1	<i>Oncaea media</i>.....	..	f
<i>Corycaeus anglicus</i>	1	..	<i>minuta</i>	f	c
<i>catus</i>	2	..	<i>similis</i>	r	..
<i>crassiusculus</i>	c	a	<i>venusta</i>	f	f
<i>longistylis</i>	f	c	<i>Paracalanus parvus</i>	f	c
<i>speciosus</i>	c	c	<i>Pontella tenuiremis</i>	f	..
<i>typicus</i>	3	..	<i>Pontellina plumata</i>	1	..
<i>Euchaeta acuta</i>.....	..	f	<i>Pseudocalanus minutus</i>.....	..	c
<i>marina</i>	c	a	<i>Sapphirina nigromaculata</i>.....	..	1
<i>Farranula carinata</i>	c	a	<i>Scolecithrix danae</i>.....	..	a
<i>curta</i>	r	..	<i>Spinocalanus magnus</i>.....	..	1
<i>gibbula</i>	r	2			

The temperature, salinity, and hydrogen-ion concentration varied extremely little at the two depths. Twenty-five species were present at the surface and 34 in the 50-meter tow. Thirty-one species (70 per cent) were found in one tow but not in the other, and 14 were common to both tows. *Corycaeus*, *Farranula*, and *Oncaea* were well distributed between

the two tows, but *Oithona* was much more abundant in the deeper tow. The 50-meter tow was two and a half times as large as the surface tow although its length was only one-half greater. *Paracalanus* appeared in both tows, but *Pseudocalanus* was confined to the deeper tow, along with *Calanus* and *Candacia*.

STATION 91

March 27, 1929; 15° 44' S, 160° 25' W; bottom depth, 4937 m; 50 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	28.7	28.5	Density (σ_{tP})	22.2	22.6
Salinity, o/oo	35.1	35.2	Hydrogen-ion concentration (pH)	8.30	8.30
Volume of tow, cm ³	32	32	Length of tow, miles	0.6	0.8

<i>Acartia danae</i>	f	f	<i>Euchaeta marina</i>	c	a
<i>Acrocalanus gracilis</i>	c	c	<i>Euchirella curticauda</i>.....	..	4
<i>longicornis</i>.....	..	2	<i>pulchra</i>	1	..
<i>monachus</i>	a	f	<i>Farranula carinata</i>	c	a
<i>Calanus minor</i>.....	..	f	<i>gibbula</i>	f	..
<i>Calocalanus pavo</i>.....	..	1	<i>gracilis</i>.....	..	r
<i>Candacia bispinosa</i>.....	..	1	<i>rostrata</i>	f	f
<i>Clausocalanus arcuicornis</i>.....	..	2	<i>Labidocera detruncata</i>	f	..
<i>Copilia denticulata</i>	1	4	<i>Microcalanus pusillus</i>.....	..	1
<i>quadrata</i>.....	..	1	<i>pygmaeus</i>.....	..	f
<i>Corycaeus agilis</i>	f	..	<i>Microsetella rosea</i>.....	..	f
<i>anglicus</i>	f	..	<i>Neocalanus robustior</i>.....	..	1
<i>catus</i>	c	..	<i>Oithona plumifera</i>.....	..	f
<i>clausi</i>	r	..	<i>similis</i>.....	..	f
<i>crassiusculus</i>	2	c	<i>Oncaea curta</i>	2	..
<i>flaccus</i>	1	..	<i>media</i>.....	..	f
<i>furcifer</i>.....	..	1	<i>minuta</i>.....	..	c
<i>giesbrechti</i>	f	..	<i>similis</i>.....	..	f
<i>lautus</i>	3	..	<i>venusta</i>.....	..	c
<i>limbatus</i>	r	..	<i>Paracalanus parvus</i>.....	..	c
<i>longistylis</i>	f	2	<i>Pontella lobiancoi</i>.....	..	f
<i>ovalis</i>	4	..	<i>tenuiremis</i>	f	..
<i>pacificus</i>	3	..	<i>Pseudocalanus minutus</i>.....	..	f
<i>speciosus</i>	c	f	<i>Sapphirina nigromaculata</i>	1	..
<i>typicus</i>	f	..	<i>Scolecithrix danae</i>.....	..	a

The temperature, salinity, and hydrogen-ion concentration were high and practically the same at both depths. Twenty-seven species were found at the surface and 33 in the 50-meter tow. Forty species (80 per cent) were present in one tow but not in the other, and 10 were found in both tows.

Corycaeus, with 15 species, was especially abundant at the surface; *Farranula*, *Oithona*, and *Oncaea* were more abundant in the deeper tow. Although the 50-meter tow was here one-third longer than the surface tow, its volume was exactly the same.

STATION 92

March 29, 1929; 15° 18' S, 163° 14' W; bottom depth, 5530 m; 27 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	28.5	28.4	Density (σ_{tP})	22.4	22.8
Salinity, ‰	35.3	35.4	Hydrogen-ion concentration (pH)	8.29	8.29
Volume of tow, cm ³	32	32	Length of tow, miles	0.4	0.5

<i>Acartia danae</i>.....	..	c	<i>Euchirella curticauda</i>.....	..	1
<i>Acrocalanus gibber</i>.....	..	2	<i>Farranula carinata</i>	c	c
<i>gracilis</i>	f	..	<i>gibbula</i>	f	..
<i>monachus</i>.....	..	f	<i>rostrata</i>	f	c
<i>Candacia bispinosa</i>.....	..	2	<i>Mecynocera clausi</i>.....	..	3
<i>simplex</i>	1	..	<i>Megacalanus longicornis</i>.....	..	1
<i>Clausocalanus arcuicornis</i>	f	..	<i>Microsetella rosea</i>.....	..	c
<i>Copilia denticulata</i>.....	..	5	<i>Neocalanus gracilis</i>.....	..	3
<i>quadrata</i>.....	..	1	<i>Oithona similis</i>.....	..	f
<i>Corycaeus crassiusculus</i>	4	c	<i>spirostris</i>.....	..	2
<i>pumilus</i>.....	..	f	<i>Oncaea minuta</i>.....	..	f
<i>speciosus</i>.....	..	f	<i>Paracalanus parvus</i>	f	c
<i>typicus</i>	2	..	<i>Pseudocalanus minutus</i>	f	c
<i>Euchaeta marina</i>.....	..	c			

The temperature, salinity, and hydrogen-ion concentration were high and practically the same at the two depths. Ten species were taken at the surface and 22 in the 50-meter net. Twenty-two species (80 per cent) were present in one tow

and not in the other, and 5 were found in both tows. *Corycaeus* and *Farranula* were well divided between the two tows; *Oithona* and *Oncaea* were both found only in the 50-meter tow.

STATION 93

March 31, 1929; 14° 41' S, 167° 41' W; bottom depth, 5208 m; 56 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	28.7	28.5	Density (σ_{tP})	21.9	22.3
Salinity, o/oo	34.7	34.7	Hydrogen-ion concentration (pH)	8.30	8.30
Volume of tow, cm ³	32	32	Length of tow, miles	0.2	0.3

<i>Acartia danae</i>.....	..	c	<i>Euchirella curticauda</i>.....	..	1
<i>Acrocalanus gibber</i>	f	f	<i>Farranula carinata</i>	a	f
<i>gracilis</i>	a	a	<i>gibbula</i>	f	..
<i>longicornis</i>	f	f	<i>rostrata</i>	a	a
<i>monachus</i>.....	..	c	<i>Labidocera detruncata</i>.....	..	1
<i>Calanus minor</i>	f	f	<i>Macrosetella gracilis</i>	1	..
<i>Calocalanus pavo</i>.....	..	1	<i>Microcalanus pygmaeus</i>.....	..	f
<i>plumulosus</i>.....	..	1	<i>Microsetella rosea</i>.....	..	f
<i>styliremis</i>.....	..	2	<i>Neocalanus gracilis</i>.....	..	f
<i>Candacia bispinosa</i>.....	..	f	<i>Oithona attenuata</i>.....	..	2
<i>norvegica</i>.....	..	3	<i>brevicornis</i>.....	..	1
<i>simplex</i>	f	c	<i>similis</i>.....	..	c
<i>truncata</i>.....	..	5	<i>spirostris</i>.....	..	4
<i>Centropages calaninus</i>.....	..	c	<i>Oithonina nana</i>	2	..
<i>Clausocalanus arcuicornis</i>.....	..	f	<i>Oncaea minuta</i>	f	c
<i>Corycaeus andrewsi</i>	f	..	<i>tenella</i>.....	..	1
<i>clausi</i>	2	..	<i>venusta</i>	c	a
<i>crassiusculus</i>	f	a	<i>Paracalanus parvus</i>	f	..
<i>giesbrechti</i>.....	..	3	<i>Pontella tenuiremis</i>	f	..
<i>longistylis</i>.....	..	c	<i>Pontellina plumata</i>.....	..	5
<i>ovalis</i>.....	..	f	<i>Pseudocalanus minutus</i>	f	c
<i>pacificus</i>.....	..	f	<i>Sapphirina auronitens</i>.....	..	1
<i>pumilus</i>.....	..	3	<i>nigromaculata</i>.....	..	2
<i>speciosus</i>	r	c	<i>Scolecithricella minor</i>.....	..	1
<i>Eucalanus attenuatus</i>.....	..	1	<i>Scolecithrix danae</i>.....	..	a
<i>elongatus</i>.....	..	2	<i>Temora discaudata</i>.....	..	2
<i>Euchaeta marina</i>.....	..	f	<i>Undinula darwinii</i>.....	..	2
<i>Euchirella brevis</i>.....	..	5	<i>vulgaris</i>.....	..	f

The temperature and hydrogen-ion concentration were high, the salinity a little lower, but all three remained about the same at the two depths. Nineteen species were found at the surface and 49 in the 50-meter tow. Forty-four species (80 per cent) were confined to one of the two tows and 12

were found in both tows. *Corycaeus* and *Oithona* were more abundant in the deeper tow, the latter not appearing at all at the surface. *Farranula* and *Oncaea* were about evenly divided between the two tows. Only one *Candacia* (*simplex*) appeared at the surface, the others only in the 50-meter net.

OFF SAMOA

15 species

<i>Acartia danae</i>	f	<i>Candacia simplex</i>	2	<i>Oncaea media</i>	r
<i>Calanopia elliptica</i>	a	<i>Canthocalanus pauper</i>	1	<i>minuta</i>	f
<i>Calanus minor</i>	f	<i>Microcalanus pygmaeus</i>	2	<i>ornata</i>	5 ♀
<i>propinquus</i>	1	<i>Oithona plumifera</i>	2	<i>Paracalanus parvus</i>	f
<i>Calocalanus styliremis</i>	2	<i>spirostris</i>	1	<i>Undinula vulgaris</i>	a

Every one of the 15 species obtained in this surface tow was as distinctly pelagic as those captured in the open ocean. The littoral copepods of these oceanic islands do not seem to venture very far into the surrounding ocean. On the contrary,

the pelagic copepods come in very close to the shore, especially at the surface. *Undinula* and *Calanopia* made up about 90 per cent of this tow, each of the other genera being confined to a few specimens.

STATION 94

April 22, 1929; 12° 47' S, 171° 35' W; bottom depth, 4760 m; 64 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	29.4	29.3	28.5	Density (σ_{tP})	21.7	22.0	23.1
Salinity, o/oo	34.7	34.7	35.5	Hydrogen-ion conc. (pH)	8.25	8.25	8.21
Volume of tow, cm ³	34	48	80	Length of tow, miles	1.0	1.2	1.3
<i>Acartia danae</i>.....	..	..	f	<i>Farranula rostrata</i>	1	c	c
<i>negligens</i>	2	..	2	<i>Haloptilus longicornis</i>.....	..	..	a
<i>Acrocalanus gracilis</i>.....	..	c	f	<i>spiniceps</i>.....	..	..	3
<i>longicornis</i>.....	..	1	..	<i>Heterorhabdus papilliger</i>.....	..	..	1
<i>monachus</i>.....	..	f	..	<i>Lubbockia squillimana</i>.....	..	..	f
<i>Calanus minor</i>.....	..	f	c	<i>Lucicutia flavicornis</i>.....	..	..	f
<i>Calocalanus pavo</i>.....	..	..	2	<i>Macrosetella oculata</i>.....	..	..	1
<i>Candacia bispinosa</i>.....	..	c	f	<i>Mecynocera clausi</i>.....	..	..	f
<i>norvegica</i>.....	..	2	..	<i>Microcalanus pusillus</i>.....	..	..	2
<i>simplex</i>.....	..	a	..	<i>pygmaeus</i>.....	..	f	f
<i>truncata</i>.....	..	a	c	<i>Microsetella rosea</i>.....	..	f	f
<i>Canthocalanus pauper</i>.....	..	4	..	<i>Neocalanus gracilis</i>.....	..	..	2
<i>Centropages calaninus</i>.....	..	..	2	<i>Oithona attenuata</i>.....	..	..	2
<i>Clausocalanus arcuicornis</i>.....	..	c	f	<i>plumifera</i>.....	..	f	f
<i>Clytemnestra scutellata</i>.....	..	..	1	<i>setiger</i>.....	..	..	5
<i>Copilia denticulata</i>.....	..	5	f	<i>similis</i>.....	..	f	c
<i>quadrata</i>.....	..	2	2	<i>spinirostris</i>.....	..	f	f
<i>Corycaeus agilis</i>.....	..	r	..	<i>Oncaea media</i>.....	..	f	..
<i>crassiusculus</i>	1	a	c	<i>mediterranea</i>	3	..	..
<i>lautus</i>	2	..	..	<i>minuta</i>.....	..	a	c
<i>longistylis</i>.....	..	c	f	<i>venusta</i>.....	..	a	c
<i>pumilus</i>.....	..	r	..	<i>Paracalanus parvus</i>.....	..	c	c
<i>speciosus</i>.....	..	c	c	<i>Pontellina plumata</i>.....	..	3	2
<i>typicus</i>.....	..	..	4	<i>Pseudocalanus minutus</i>.....	..	f	c
<i>Danodes plumata</i> , n. gen. and n. sp.	1 ♀	..	..	<i>Sapphirina angusta</i>.....	..	1	..
<i>Eucalanus attenuatus</i>.....	..	f	f	<i>auronitens</i>	2	..	..
<i>crassus</i>.....	..	3	..	<i>metallina</i>.....	..	..	1
<i>elongatus</i>.....	..	5	..	<i>nigromaculata</i>.....	..	4	3
<i>Euchaeta marina</i>.....	..	f	f	<i>Scolecithrix danae</i>.....	..	c	f
<i>Farranula carinata</i>	2	a	c	<i>Undinula darwinii</i>.....	..	f	..
<i>curta</i>.....	..	f	..	<i>vulgaris</i>.....	..	a	..
<i>gibbula</i>.....	..	..	f	<i>Vettoria granulosa</i>.....	..	..	2

Temperature high, diminishing only about 1° in the 100 meters; salinity moderate, increasing nearly 1 point at the 100-meter depth; hydrogen-ion concentration fairly high, changing scarcely at all. Eight species were found at the surface, 39 in the 50-meter tow, and 46 in the 100-meter tow. Thirty-six species (56 per cent) were confined to a single tow and only 3 were present in all three tows. *Corycaeus* and

Farranula were well distributed in depth and included the 3 species just mentioned, no other genus appearing at all the depths. *Candacia* and *Oncaea* were most abundant in the 50-meter tow, and *Oithona* in the 100-meter tow. The 100-meter tow was 30 per cent longer than the surface tow and 10 per cent longer than the 50-meter tow, but its proportionate volume was considerably greater.

STATION 95

April 24, 1929; 8° 43' S, 170° 56' W; bottom depth, 4298 m; 74 species

Depth of tow, m	50	100	Depth of tow, m	50	100
Temperature, °C	29.3	28.5	Density (σ_{tP})	22.1	23.1
Salinity, ‰	34.9	35.4	Hydrogen-ion concentration (pH)	8.24	8.22
Volume of tow, cm ³	48	80	Length of tow, miles	1.9	2.2

<i>Acrocalanus gibber</i>	2	4	<i>Farranula rostrata</i>	f	f
<i>gracilis</i>	c	c	<i>Haloptilus longicornis</i>.....	..	a
<i>longicornis</i>	1	f	<i>Lubbockia aculeata</i>.....	..	3
<i>monachus</i>	a	c	<i>squillimana</i>.....	..	f
<i>Amalothrix propinqua</i>.....	..	3	<i>Lucicutia bicornuta</i>.....	..	2
<i>Calanus minor</i>	f	c	<i>clausii</i>.....	..	f
<i>Calocalanus pavo</i>	1	..	<i>flavicornis</i>.....	..	c
<i>Candacia aethiopica</i>	4	f	<i>Macrosetella gracilis</i>	2	..
<i>bispinosa</i>	4	..	<i>Mecynocera clausi</i>	2	3
<i>norvegica</i>.....	..	2	<i>Megacalanus longicornis</i>.....	..	1
<i>simplex</i>	a	f	<i>Microcalanus pusillus</i>	2	2
<i>truncata</i>	a	c	<i>pygmaeus</i>	f	f
<i>Canthocalanus pauper</i>.....	..	1	<i>Microsetella rosea</i>	c	c
<i>Centropages calaninus</i>	f	..	<i>Neocalanus gracilis</i>.....	..	4
<i>Clausocalanus arcuicornis</i>	f	c	<i>robustus</i>.....	..	4
<i>Clytemnestra rostrata</i>	1	..	<i>Oithona fallax</i>.....	..	2
<i>Copilia denticulata</i>	f	f	<i>plumifera</i>	f	..
<i>quadrata</i>	3	2	<i>setiger</i>.....	..	2
<i>vitrea</i>	1	..	<i>similis</i>	c	c
<i>Corycaeus anglicus</i>.....	..	r	<i>spinirostris</i>	f	f
<i>clausi</i>.....	..	2	<i>Oithonina nana</i>	2	2
<i>crassiusculus</i>	c	a	<i>Oncaea curta</i>	r	..
<i>dubius</i>.....	..	1	<i>media</i>.....	..	f
<i>furcifer</i>.....	..	r	<i>minuta</i>	c	a
<i>limbatus</i>	1	..	<i>similis</i>	c	..
<i>longistylis</i>	2	f	<i>tenella</i>	2	..
<i>ovalis</i>	3	..	<i>venusta</i>	a	a
<i>pumilus</i>	f	..	<i>Paracalanus parvus</i>	c	c
<i>speciosus</i>	3	..	<i>Pseudocalanus minutus</i>	c	c
<i>Eucalanus attenuatus</i>	f	f	<i>Rhincalanus cornutus</i>	1	..
<i>crassus</i>	f	..	<i>Sapphirina auronitens</i>	2	1
<i>elongatus</i>	f	..	<i>metallina</i>.....	..	3
<i>Euchaeta marina</i>	c	c	<i>nigromaculata</i>	1	3
<i>Euchirella brevis</i>	1	2	<i>Scolecithricella minor</i>	1	..
<i>Farranula carinata</i>	c	a	<i>Scolecithrix danae</i>	c	c
<i>curta</i>	4	..	<i>Undinula darwinii</i>	2	f
<i>gibbula</i>	f	..	<i>VetTORIA granulosa</i>.....	..	4

The temperature was high and diminished nearly 1°; the salinity increased half a point, and the hydrogen-ion concentration remained practically the same. Fifty-three species were taken in the 50-meter tow and 54 in the 100-meter tow, an exceptionally even depth distribution. Forty-one

species (55 per cent) were present in one tow and absent from the other, and 33 were found in both tows. The 100-meter tow contains one of the few records for *Amalothrix propinqua*. *Candacia*, *Corycaeus*, *Farranula*, *Oithona*, and *Oncaea* were each well divided between the two tows.

BETWEEN STATIONS 95 AND 96

April 25, 1929; 7° 59' S, 171° 49' W; 16 species

<i>Acrocalanus gibber</i>	f	<i>Centropages calaninus</i>	1	<i>Farranula rostrata</i>	f
<i>gracilis</i>	c	<i>Corycaeus crassiusculus</i>	f	<i>Oithona plumifera</i>	1
<i>monachus</i>	f	<i>speciosus</i>	2	<i>similis</i>	2
<i>Calanus minor</i>	c	<i>Euchaeta acuta</i>	4	<i>Paracalanus parvus</i>	c
<i>Calocalanus plumulosus</i>	1	<i>Farranula carinata</i>	f	<i>Pseudocalanus minutus</i>	c
<i>Candacia simplex</i>	a				

This surface tow yielded 16 species, but most of the tow was made up of development stages of *Candacia simplex*.

STATION 96

April 26, 1929; 6° 47' S, 172° 23' W; bottom depth, 5269 m; 68 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	29.3	29.2	28.2	Density (σ_t)	22.1	22.4	23.2
Salinity, ‰	35.2	35.2	35.6	Hydrogen-ion conc. (pH)	8.23	8.23	8.19
Volume of tow, cm ³	48	64	64	Length of tow, miles	0.9	1.2	1.2

<i>Acartia danae</i>.....	..	c	..	<i>Farranula rostrata</i>	c	f	f
<i>negligens</i>.....	..	..	2	<i>Haloptilus longicornis</i>.....	..	..	a
<i>Acrocalanus gracilis</i>.....	..	c	c	<i>spiniceps</i>.....	..	..	2
<i>longicornis</i>.....	..	f	..	<i>Heterorhabdus papilliger</i>.....	..	..	2
<i>monachus</i>.....	..	..	2	<i>Lubbockia squillimana</i>.....	..	..	1
<i>Amalothrix obtusifrons</i>.....	..	..	4	<i>Lucicutia clausii</i>.....	..	..	c
<i>Calanus minor</i>	f	a	c	<i>flavicornis</i>.....	..	..	a
<i>Calocalanus pavo</i>.....	..	2	2	<i>Macrosetella gracilis</i>	2	2	1
<i>Candacia bispinosa</i>.....	..	c	c	<i>oculata</i>.....	..	..	1
<i>norvegica</i>.....	..	f	f	<i>Microcalanus pusillus</i>.....	..	..	2
<i>simplex</i>	c	a	a	<i>pygmaeus</i>.....	..	f	f
<i>truncata</i>.....	..	c	f	<i>Microsetella rosea</i>.....	..	c	f
<i>Centropages calaninus</i>	2	f	f	<i>Neocalanus gracilis</i>.....	..	..	4
<i>Clausocalanus arcuicornis</i>.....	..	f	f	<i>robustior</i>.....	..	..	f
<i>Clytemnestra rostrata</i>.....	..	..	1	<i>Oithona attenuata</i>.....	..	2	2
<i>scutellata</i>.....	..	2	..	<i>plumifera</i>.....	..	f	2
<i>Copilia denticulata</i>.....	..	f	4	<i>similis</i>.....	..	f	f
<i>vitrea</i>.....	..	..	2	<i>spirostris</i>.....	..	4	1
<i>Corycaeus catus</i>.....	..	..	f	<i>Oncaea media</i>.....	..	..	r
<i>crassiusculus</i>	1	c	c	<i>minuta</i>	f	c	c
<i>dubius</i>.....	..	r	..	<i>similis</i>.....	..	3	..
<i>giesbrechti</i>.....	..	2	..	<i>venusta</i>	f	a	a
<i>limbatus</i>	r	..	..	<i>Paracalanus parvus</i>	f	c	c
<i>longistylis</i>.....	..	f	f	<i>Phaenna spinifera</i>.....	..	2	..
<i>pumilus</i>	2	..	..	<i>Pontella tenuiremis</i>	1	..	..
<i>speciosus</i>.....	..	f	f	<i>Pontellina plumata</i>	1	4	..
<i>typicus</i>.....	..	f	..	<i>Pseudocalanus minutus</i>.....	..	c	c
<i>Eucalanus attenuatus</i>.....	..	f	..	<i>Sapphirina auronitens</i>	c	..	f
<i>crassus</i>.....	..	f	..	<i>nigromaculata</i>.....	..	..	2
<i>elongatus</i>.....	..	..	1	<i>Scolecithricella minor</i>.....	..	3	..
<i>Euchaeta marina</i>.....	..	c	f	<i>Scolecithrix danae</i>.....	..	c	c
<i>Farranula carinata</i>	c	a	a	<i>Undinula caroli</i>.....	..	2	..
<i>curta</i>	3	..	..	<i>darwinii</i>.....	..	f	..
<i>gibbula</i>	f	..	c	<i>Vettopia granulosa</i>.....	..	..	3

The temperature was high and dropped 1° at a depth of 100 meters; the salinity rose and the hydrogen-ion concentration fell, both very slightly. Seventeen species were found at the surface, 41 in the 50-meter tow, and 50 in the 100-meter tow. Thirty-nine species (56 per cent) were each confined to a single tow and 10 were found in all three tows. *Corycaeus*, *Farranula*, and *Oncaea* were well divided among the three

tows, but *Oithona* did not appear at all at the surface. Three of the *Candacia* species, *Eucalanus*, *Euchaeta*, and *Undinula* were present only in the two deeper tows; *Haloptilus*, *Heterorhabdus*, *Lubbockia*, and *Lucicutia* were confined to the 100-meter tow. The 50-meter and 100-meter tows were each 33 per cent longer than the surface tow and their proportionate volume corresponded exactly.

STATION 97

April 28, 1929; 3° 47' S, 172° 39' W; bottom depth, 5253 m; 74 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	28.3	28.0	27.6	Density (σ_{tP})	22.4	22.9	23.4
Salinity, ‰	35.1	35.3	35.5	Hydrogen-ion conc. (pH)	8.16	8.16	8.15
Volume of tow, cm ³	32	36	80	Length of tow, miles	0.5	0.6	0.6

<i>Acartia danae</i>.....	..	c	c	<i>Haloptilus spiniceps</i>.....	..	2	..
<i>negligens</i>.....	..	r	..	<i>Heterorhabdus papilliger</i>.....	..	..	1
<i>Acrocalanus gibber</i>	a	f	f	<i>Labidocera detruncata</i>	2	..	..
<i>gracilis</i>	a	c	c	<i>Lucicutia flavicornis</i>.....	..	..	c
<i>longicornis</i>	f	c	..	<i>longicornis</i>.....	..	..	1
<i>monachus</i>	f	c	2	<i>Macrosetella gracilis</i>.....	..	2	..
<i>Calanus minor</i>.....	..	c	c	<i>Mecynocera clausi</i>.....	..	2	..
<i>tonsus</i>	1	..	..	<i>Megacalanus longicornis</i>.....	..	f	4
<i>Calocalanus pavo</i>	2	5	2	<i>Microcalanus pusillus</i>.....	..	..	4
<i>Candacia bispinosa</i>.....	..	..	f	<i>pygmaeus</i>	f	..	f
<i>simplex</i>	2	..	..	<i>Microsetella norvegica</i>.....	..	f	..
<i>truncata</i>.....	..	f	f	<i>rosea</i>.....	..	c	c
<i>Canthocalanus pauper</i>.....	..	c	..	<i>Miracia efferata</i>.....	..	2	..
<i>Centropages calaninus</i>	f	f	2	<i>Neocalanus gracilis</i>.....	..	f	f
<i>Clausocalanus arcuicornis</i>.....	..	f	f	<i>robustior</i>.....	..	f	c
<i>Clytemnestra scutellata</i>.....	..	2	1	<i>tenuicornis</i>.....	..	1	..
<i>Copilia denticulata</i>.....	..	f	4	<i>Oithona attenuata</i>.....	..	..	f
<i>quadrata</i>.....	..	2	..	<i>plumifera</i>.....	..	4	f
<i>Corycaeus agilis</i>	3	..	..	<i>similis</i>.....	..	f	c
<i>catus</i>.....	..	r	..	<i>spirostris</i>.....	..	..	4
<i>crassiusculus</i>	c	c	c	<i>Oncaea curta</i>	2	..	..
<i>lautus</i>	r	..	..	<i>mediterranea</i>	1	..	..
<i>longistylis</i>	f	f	3	<i>minuta</i>	c	a	a
<i>lubbockii</i>.....	..	2	..	<i>similis</i>.....	..	r	..
<i>speciosus</i>.....	..	c	f	<i>venusta</i>	c	a	a
<i>typicus</i>.....	..	..	f	<i>Paracalanus parvus</i>	c	a	c
<i>Eucalanus attenuatus</i>.....	..	f	f	<i>Pontella tenuiremis</i>	3	..	..
<i>crassus</i>.....	..	2	1	<i>Pontellina plumata</i>.....	..	f	1
<i>elongatus</i>.....	..	5	f	<i>Pseudocalanus minutus</i>	c	c	c
<i>Euchaeta acuta</i>.....	..	f	..	<i>Sapphirina angusta</i>	3	..	..
<i>marina</i>	f	a	c	<i>auronitens</i>	2	..	2
<i>Euchirella brevis</i>.....	..	4	1	<i>metallina</i>	2	3	..
<i>Farranula carinata</i>	c	c	..	<i>nigromaculata</i>.....	..	2	..
<i>concinna</i>.....	..	..	r	<i>ovato lanceolata</i>	1	..	..
<i>gibbula</i>.....	..	..	f	<i>Scolecithrix danae</i>	2	a	c
<i>rostrata</i>	a	c	..	<i>Undinula caroli</i>.....	..	f	..
<i>Haloptilus longicornis</i>.....	..	..	a	<i>darwinii</i>.....	..	c	c

The temperature, salinity, and hydrogen-ion concentration were high and changed very little in the 100 meters. Twenty-nine species were found at the surface, 51 in the 50-meter tow, and 45 in the 100-meter tow. Thirty-six species (49 per cent) were each confined to a single tow and 13 were present in all three tows. *Corycaeus*, *Farranula*, and *Oncaea* were divided among the three tows, but *Eucalanus*, *Euchirella*,

Oithona, and *Undinula* were found only in the two deeper tows. The surface tow contained one of the two records for *Sapphirina ovato lanceolata*; the other 4 species of *Sapphirina* were found, with one exception, in the two higher tows. The two deeper tows were each 20 per cent longer than the surface tow; the volume of the 50-meter tow was 10 per cent larger, but that of the 100-meter tow was 150 per cent larger.

STATION 98

April 30, 1929; 0° 18' N, 173° 59' W; bottom depth, 5599 m; 72 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.0	26.9	26.7	Density (σ_{tP})	22.9	23.2	23.5
Salinity, o/oo	35.2	35.3	35.4	Hydrogen-ion conc. (pH)	8.16	8.16	8.14
Volume of tow, cm ³	48	80	96	Length of tow, miles	1.3	1.3	1.3

<i>Acartia danae</i>	c	..	c	<i>Farranula rostrata</i>	c	..	..
<i>Acrocalanus gibber</i>.....	..	f	..	<i>Haloptilus longicornis</i>.....	..	..	f
<i>gracilis</i>	a	c	f	<i>Labidocera detruncata</i>	2	..	..
<i>longicornis</i>.....	..	f	..	<i>Lucicutia clausii</i>.....	..	f	..
<i>monachus</i>.....	..	f	..	<i>Macrosetella gracilis</i>	1	1	2
<i>Calanus minor</i>.....	..	f	c	<i>oculata</i>.....	..	1	..
<i>tonsus</i>	1	..	..	<i>Mecynocera clausi</i>.....	..	2	..
<i>Calocalanus plumulosus</i>.....	..	..	1	<i>Microcalanus pusillus</i>.....	..	..	f
<i>Candacia bispinosa</i>.....	..	..	2	<i>pygmaeus</i>.....	..	c	..
<i>longimana</i>.....	..	..	4	<i>Microsetella rosea</i>	f	c	c
<i>norvegica</i>.....	..	..	2	<i>Neocalanus gracilis</i>.....	..	f	f
<i>simplex</i>.....	..	f	..	<i>robustior</i>.....	..	2	f
<i>truncata</i>.....	..	c	c	<i>Oithona attenuata</i>	f	f	3
<i>Canthocalanus pauper</i>	2	f	f	<i>fallax</i>	1	..	..
<i>Centropages calaninus</i>	2	f	f	<i>plumifera</i>.....	..	f	f
<i>Clausocalanus arcuicornis</i>	a	f	f	<i>similis</i>	f	f	f
<i>Clytemnestra rostrata</i>.....	..	2	..	<i>spirostris</i>.....	..	f	f
<i>scutellata</i>.....	..	..	3	<i>Oncaea conifera</i>.....	..	2	..
<i>Copilia denticulata</i>.....	..	1	..	<i>media</i>	f	..	..
<i>quadrata</i>.....	..	2	..	<i>minuta</i>	f	c	a
<i>Corycaeus crassiusculus</i>	f	a	..	<i>venusta</i>	c	a	a
<i>furcifer</i>	3	..	..	<i>Pachos punctatum</i>.....	..	..	2
<i>longistylis</i>	f	1	f	<i>tuberosum</i>.....	..	1	..
<i>pumilus</i>	1	..	..	<i>Paracalanus parvus</i>	a	c	c
<i>robustus</i>.....	..	1	..	<i>Pontellina plumata</i>	c	f	3
<i>speciosus</i>	f	c	f	<i>Pontellopsis armata</i>	2 ♀	..	..
<i>typicus</i>.....	..	r	..	<i>Pseudocalanus minutus</i>	a	c	c
<i>Eucalanus attenuatus</i>	3	f	f	<i>Rhincalanus cornutus</i>.....	..	1	1
<i>elongatus</i>.....	..	f	4	<i>Sapphirina angusta</i>	2	..	..
<i>Euchaeta acuta</i>.....	..	f	f	<i>auronitens</i>	2	4	..
<i>marina</i>.....	..	a	c	<i>metallina</i>.....	..	f	5
<i>Euchirella brevis</i>.....	..	..	2	<i>nigromaculata</i>.....	..	4	5
<i>Farranula carinata</i>	c	c	..	<i>opalina</i>.....	..	1	..
<i>curta</i>	3	..	..	<i>Scolecithrix danae</i>	1	c	c
<i>gibbula</i>	f	..	..	<i>Undinula caroli</i>.....	..	f	c
<i>gracilis</i>.....	..	2	..	<i>darwinii</i>.....	..	f	c

The temperature, salinity, and hydrogen-ion concentration showed but little variation at the three depths. Thirty-two species were found at the surface, 51 in the 50-meter tow, and 41 in the 100-meter tow. Thirty-seven species (50 per cent) were each confined to a single tow and 16 were present in all three tows. *Corycaeus*, *Oithona*, *Oncaea*, and *Sapphirina* were well distributed at all three depths, but *Farranula* did not appear at all in the deepest tow. *Candacia*, *Euchaeta*, and *Undinula* were confined to the two deeper tows. The surface

tow contained the only record for *Pontellopsis armata* and the 50-meter tow one of the very few records for *Pachos tuberosum*. The three tows were of exactly the same length, but the volume of the 50-meter tow was 66 per cent, and of the 100-meter tow 100 per cent, larger than that of the surface tow. About one-quarter of the abundance records are expressed in numerals from 1 to 5, but in the other three-quarters enough species are designated as abundant or common to more than offset this scarcity.

STATION 99

May 2, 1929; 4° 22' N, 176° 23' W; bottom depth, 4951 m; 52 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.9	27.8	27.8	Density (σ_{tP})	22.3	22.6	22.9
Salinity, o/oo	34.9	34.9	35.0	Hydrogen-ion conc. (pH)	8.21	8.22	8.22
Volume of tow, cm ³	48	48	80	Length of tow, miles	0.5	0.5	0.7

<i>Acartia danae</i>.....	..	f	c	<i>Farranula carinata</i>	c	..	..
<i>Acrocalanus gibber</i>	a	a	a	<i>gibbula</i>	c	..	..
<i>gracilis</i>	f	c	c	<i>rostrata</i>	c	f	..
<i>longicornis</i>.....	..	2	..	<i>Labidocera detruncata</i>	4	..	..
<i>monachus</i>.....	..	1	a	<i>Lucicutia flavicornis</i>.....	..	f	..
<i>Calocalanus pavo</i>	2	1	5	<i>Macrosetella gracilis</i>.....	..	..	1
<i>plumulosus</i>.....	..	1	3	<i>Microcalanus pusillus</i>.....	..	2	f
<i>Candacia bispinosa</i>.....	..	..	4	<i>pygmaeus</i>	4	..	f
<i>norvegica</i>.....	..	2	1	<i>Microsetella rosea</i>.....	..	f	a
<i>truncata</i>.....	..	4	c	<i>Neocalanus gracilis</i>.....	..	2	..
<i>Canthocalanus pauper</i>	4	f	2	<i>robustior</i>.....	..	4	..
<i>Centropages calaninus</i>	2	2	5	<i>Oithona attenuata</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>.....	..	..	f	<i>plumifera</i>.....	..	..	f
<i>Clytemnestra rostrata</i>.....	..	2	..	<i>similis</i>.....	..	f	f
<i>scutellata</i>.....	..	..	5	<i>Oncaea media</i>.....	..	f	..
<i>Copilia quadrata</i>.....	..	..	1	<i>minuta</i>	a	c	a
<i>Corycaeus anglicus</i>.....	..	1	..	<i>venusta</i>.....	..	c	a
<i>crassiusculus</i>	c	c	c	<i>Paracalanus parvus</i>.....	..	c	f
<i>limbatus</i>.....	..	..	3	<i>Pontellina plumata</i>	1	3	3
<i>pumilus</i>.....	..	..	f	<i>Pseudocalanus minutus</i>.....	..	f	f
<i>speciosus</i>.....	..	..	f	<i>Sapphirina auronitens</i>	2	..	..
<i>Eucalanus attenuatus</i>	1	2	f	<i>nigromaculata</i>	2	..	2
<i>elongatus</i>	2	..	f	<i>scarlata</i>	1	..	..
<i>Euchaeta acuta</i>.....	..	3	2	<i>Scolecithrix danae</i>.....	..	f	a
<i>marina</i>	f	c	a	<i>Undinula caroli</i>.....	..	..	c
<i>Euchirella messinensis</i>.....	..	..	1	<i>darwinii</i>.....	..	c	a

The temperature, salinity, and hydrogen-ion concentration changed very little at the three depths. Nineteen species were found at the surface, 32 at the 50-meter depth, and 39 at the 100-meter depth. Twenty-five species (47 per cent) were each confined to a single depth and 10 were present at all three depths. *Candacia*, *Corycaeus*, *Oithona*, and *Oncaea* were largely confined to the two lower depths, and *Farranula*

was more abundant at the surface. *Canthocalanus*, *Centropages*, *Eucalanus*, and *Euchaeta* were among those appearing at all three depths; *Sapphirina* was found at the surface and in the 100-meter tow, but was entirely absent from the 50-meter tow. The 100-meter tow was 40 per cent longer than each of the other two tows, but its volume was 66 per cent larger.

STATION 100

May 4, 1929; 8° 05' N, 178° 48' W; bottom depth, 5800 m; 50 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.7	27.6	27.6	Density (σ_t)	22.2	22.5	22.7
Salinity, ‰	34.7	34.7	34.7	Hydrogen-ion conc. (pH)	8.21	8.21	8.22
Volume of tow, cm ³	48	128	80	Length of tow, miles	0.8	1.0	1.0

<i>Acartia danae</i>.....	..	c	..	<i>Eucalanus elongatus</i>.....	..	5	2
<i>Acrocalanus gibber</i>	a	..	f	<i>Euchaeta marina</i>	f	a	a
<i>gracilis</i>	a	f	c	<i>Farranula carinata</i>	c	f	2
<i>longicornis</i>	f	2	f	<i>gibbula</i>.....	..	f	..
<i>monachus</i>	f	c	5	<i>rostrata</i>	f	f	..
<i>Aetideus armatus</i>.....	..	..	1	<i>Heterorhabdus papilliger</i>.....	..	..	2
<i>Calocalanus pavo</i>	3	5	f	<i>Lucicutia flavicornis</i>.....	..	..	3
<i>styliremis</i>.....	..	..	1	<i>Microcalanus pygmaeus</i>	f	2	f
<i>Candacia bispinosa</i>.....	..	f	..	<i>Microsetella rosea</i>	f	c	f
<i>curta</i>.....	..	2	..	<i>Neocalanus gracilis</i>.....	..	..	f
<i>norvegica</i>.....	..	4	..	<i>robustior</i>.....	..	..	f
<i>simplex</i>	f	f	4	<i>Oithona attenuata</i>.....	..	..	2
<i>truncata</i>.....	..	f	f	<i>plumifera</i>.....	..	f	f
<i>Canthocalanus pauper</i>.....	..	..	f	<i>similis</i>	f	f	..
<i>Centropages calaninus</i>	2	3	..	<i>Oncaea curta</i>.....	..	3	..
<i>Clausocalanus arcuicornis</i>.....	..	..	c	<i>minuta</i>	c	c	f
<i>Copilia denticulata</i>	2	..	1	<i>venusta</i>	c	a	c
<i>Corycaeus crassiusculus</i>	a	c	c	<i>Paracalanus parvus</i>	c	f	c
<i>dubius</i>	3	..	..	<i>Pseudocalanus minutus</i>.....	..	f	..
<i>longistylis</i>	2	..	..	<i>Rhincalanus cornutus</i>	2	2	..
<i>pacificus</i>.....	..	..	1	<i>Sapphirina auronitens</i>	5	1	..
<i>speciosus</i>	c	c	f	<i>metallina</i>.....	..	..	f
<i>typicus</i>.....	..	..	3	<i>nigromaculata</i>	5	..	..
<i>Eucalanus attenuatus</i>	3	f	f	<i>Scolecithrix danae</i>.....	..	c	f
<i>crassus</i>.....	..	2	..	<i>Undinula darwinii</i>.....	..	c	c

The temperature, salinity, and hydrogen-ion concentration were practically identical at all three depths. The 50-meter tow and the 100-meter tow were of the same length, each 20 per cent longer than the surface tow, but the volume of the 50-meter tow was 50 per cent larger than that of the 100-meter tow and two and a half times as large as that of the surface tow. Twenty-five species were found at the surface,

33 in the 50-meter tow, and 35 in the 100-meter tow. Twenty-three species (46 per cent) were each confined to a single depth and 15 were present at all three depths. *Corycaeus*, *Farranula*, and *Oncaea* were well distributed at all three depths, but *Candacia* and *Oithona* were more numerous in the two deeper tows. *Rhincalanus* was confined to the two upper tows; it is usually found only in the 100-meter tow.

STATION 101

May 7, 1929; 13° 23' N, 177° 27' E; bottom depth, 5663 m; 43 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	26.3	26.2	25.2	Density (σ_{tP})	22.7	23.0	23.7
Salinity, ‰	34.7	34.7	35.0	Hydrogen-ion conc. (pH)	8.24	8.24	8.23
Volume of tow, cm ³	32	34	32	Length of tow, miles	3.0	1.5	1.8

<i>Acartia danae</i>	c	c	c	<i>Lubbockia squillimana</i>.....	..	..	2
<i>Acrocalanus gracilis</i>	f	c	c	<i>Mecynocera clausi</i>	1	1	4
<i>monachus</i>	3	c	4	<i>Megacalanus longicornis</i>.....	..	f	..
<i>Candacia bispinosa</i>.....	..	..	3	<i>Microcalanus pusillus</i>.....	..	..	2
<i>simplex</i>.....	..	..	4	<i>pygmaeus</i>.....	..	5	f
<i>truncata</i>.....	..	..	f	<i>Microsetella rosea</i>.....	..	f	f
<i>Canthocalanus pauper</i>.....	..	..	f	<i>Neocalanus gracilis</i>.....	..	..	f
<i>Centropages calaninus</i>	1	2	..	<i>robustior</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>	2	f	f	<i>Oithona attenuata</i>.....	..	f	f
<i>Copilia denticulata</i>	1	2	..	<i>plumifera</i>.....	..	..	f
<i>Corycaeus agilis</i>.....	..	r	..	<i>similis</i>.....	..	..	c
<i>crassiusculus</i>	f	c	c	<i>spirostris</i>.....	..	..	f
<i>giesbrechti</i>.....	..	2	..	<i>Oncaea venusta</i>	f	c	..
<i>longistylis</i>.....	..	5	f	<i>Paracalanus parvus</i>	f	c	f
<i>pacificus</i>.....	..	..	3	<i>Phaenna spinifera</i>.....	..	..	4
<i>speciosus</i>	3	..	f	<i>Pontellina plumata</i>.....	..	..	2
<i>Euchaeta marina</i>	a	a	..	<i>Pseudocalanus minutus</i>	f	f	f
<i>Euchirella pulchra</i>.....	..	1	..	<i>Sapphirina auronitens</i>	3	2	..
<i>Farranula carinata</i>	a	a	..	<i>Scolecithrix danae</i>.....	..	c	c
<i>gibbula</i>	f	c	f	<i>Spinocalanus abyssalis</i>.....	..	..	1
<i>rostrata</i>	f	c	f	<i>Undinula darwinii</i>	3	c	c
<i>Heterorhabdus papilliger</i>.....	..	..	2				

The temperature dropped 1° in the 100 meters, the salinity increased slightly, and the hydrogen-ion concentration remained virtually the same. Eighteen species were taken at the surface, 26 in the 50-meter tow, and 33 in the 100-meter tow. Twenty species (43 per cent) were each confined to a

single depth and 11 were present at all three depths. *Corycaeus* and *Farranula* were found in all three tows, *Oithona* and *Candacia* in the lower tows, and the single species of *Euchaeta* and *Oncaea* in the two upper tows. The surface tow was twice as long as the 50-meter tow, but its volume was smaller.

STATION 102

May 9, 1929; 16° 25' N, 171° 59' E; bottom depth, 5245 m; 45 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	25.8	25.8	25.6	Density (σ_{tP})	23.0	23.3	23.6
Salinity, ‰	34.9	34.9	35.0	Hydrogen-ion conc. (pH)	8.24	8.24	8.23
Volume of tow, cm ³	32	48	48	Length of tow, miles	2.5	2.7	2.9

<i>Acartia danae</i>	f	a	c	<i>Haloptilus longicornis</i>.....	..	..	2
<i>Acrocalanus gibber</i>.....	..	f	..	<i>Heterorhabdus papilliger</i>.....	..	..	1
<i>gracilis</i>	f	c	f	<i>Labidocera detruncata</i>	1	..	..
<i>longicornis</i>.....	..	4	..	<i>Lucicutia flavicornis</i>.....	..	..	2
<i>monachus</i>.....	..	f	2	<i>Mecynocera clausi</i>.....	..	4	..
<i>Calanus minor</i>.....	..	..	c	<i>Microcalanus pygmaeus</i>.....	..	3	1
<i>propinquus</i>.....	..	..	2	<i>Microsetella norvegica</i>.....	..	2	..
<i>Calocalanus pavo</i>	2	5	..	<i>rosea</i>	f	c	f
<i>Candacia bispinosa</i>.....	..	..	1	<i>Neocalanus gracilis</i>.....	..	..	f
<i>simplex</i>.....	..	f	3	<i>robustior</i>.....	..	..	3
<i>Canthocalanus pauper</i>.....	..	..	1	<i>Oithona attenuata</i>	2	f	f
<i>Clausocalanus arcuicornis</i>.....	..	c	f	<i>similis</i>	f	f	f
<i>Copilia denticulata</i>.....	..	2	..	<i>Oncaea media</i>.....	..	r	..
<i>Corycaeus agilis</i>.....	..	r	..	<i>minuta</i>.....	..	c	f
<i>crassiusculus</i>	f	c	c	<i>similis</i>.....	..	r	..
<i>dubius</i>	2	..	..	<i>venusta</i>.....	..	a	c
<i>longistylis</i>.....	..	f	..	<i>Paracalanus parvus</i>	c	c	f
<i>pumilus</i>.....	..	f	..	<i>Pseudocalanus minutus</i>	2	c	f
<i>speciosus</i>	f	c	..	<i>Sapphirina auronitens</i>	4	2	3
<i>Euchaeta marina</i>	1	c	a	<i>nigromaculata</i>.....	..	2	..
<i>Farranula carinata</i>	c	c	c	<i>Scolecithrix danae</i>.....	..	f	2
<i>gibbula</i>.....	..	f	..	<i>Undinula darwinii</i>.....	..	..	a
<i>rostrata</i>	c	f	c				

The temperature diminished, the salinity increased, and the hydrogen-ion concentration decreased in the 100 meters, each but very little. Sixteen species were taken at the surface, 33 in the 50-meter tow, and 29 in the 100-meter tow. Twenty-four species (54 per cent) were each confined to a single

depth and 12 were present at all three depths. *Corycaeus*, *Farranula*, and *Oithona* were well distributed at all three depths. *Candacia* and *Oncaea* were confined to the two deeper tows. These latter tows were a little longer than the one at the surface and their volume was 50 per cent larger.

STATION 103

May 11, 1929; 19° 19' N, 166° 23' E; bottom depth, 3708 m; 50 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	26.0	25.8	24.7	Density (σ_{tP})	23.0	23.4	24.0
Salinity, ‰	34.9	35.1	35.2	Hydrogen-ion conc. (pH)	8.25	8.25	8.25
Volume of tow, cm ³	36	35	33	Length of tow, miles	0.5	0.4	0.5

<i>Acartia danae</i>.....	..	c	f	<i>Heterorhabdus spinifrons</i>.....	..	..	1
<i>Acrocalanus gracilis</i>	1	c	f	<i>Labidocera detruncata</i>	1	..	..
<i>longicornis</i>.....	..	f	..	<i>Mecynocera clausi</i>.....	..	2	..
<i>monachus</i>.....	..	f	2	<i>Microcalanus pusillus</i>	r	..	r
<i>Calanus minor</i>.....	..	..	c	<i>pygmaeus</i>.....	..	2	3
<i>Calocalanus pavo</i>.....	..	2	2	<i>Microsetella rosea</i>	2	f	c
<i>plumulosus</i>.....	..	f	..	<i>Neocalanus gracilis</i>.....	..	..	f
<i>Candacia bispinosa</i>.....	..	2	4	<i>robustior</i>.....	..	..	2
<i>longimana</i>	3	..	2	<i>Oithona attenuata</i>.....	..	c	f
<i>simplex</i>.....	..	a	f	<i>similis</i>.....	..	c	f
<i>Canthocalanus pauper</i>.....	..	f	4	<i>spinirostris</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>.....	..	f	f	<i>Oncaea curta</i>.....	..	..	2
<i>furcatus</i>	3	..	..	<i>media</i>.....	..	f	..
<i>Clytemnestra scutellata</i>.....	..	1	..	<i>minuta</i>.....	..	c	c
<i>Copilia denticulata</i>.....	..	f	..	<i>venusta</i>.....	..	a	c
<i>quadrata</i>.....	..	f	1	<i>Onchocalanus nudipes, n. sp.</i>	2	..	1
<i>Corycaeus clausi</i>.....	..	2	..	<i>Paracalanus parvus</i>.....	..	f	f
<i>crassiusculus</i>.....	..	a	c	<i>Pontellina plumata</i>.....	..	..	1
<i>robustus</i>.....	..	..	1	<i>Pseudocalanus minutus</i>	1	f	f
<i>speciosus</i>.....	..	f	c	<i>Sapphirina angusta</i>	3	..	..
<i>Euchaeta marina</i>.....	..	1	a	<i>auronitens</i>.....	..	f	3
<i>Farranula carinata</i>	f	c	c	<i>metallina</i>.....	..	2	..
<i>gibbula</i>	f	..	f	<i>nigromaculata</i>.....	..	4	2
<i>rostrata</i>	f	f	f	<i>Scolecithrix danae</i>.....	..	..	1
<i>Haloptilus longicornis</i>.....	..	..	3	<i>Undinula darwinii</i>.....	..	f	c

The temperature decreased a trifle more than 1° in the 100 meters; the salinity increased less than half a point, and the hydrogen-ion concentration remained constant. Twelve species were obtained at the surface, 33 in the 50-meter tow, and 39 in the 100-meter tow. Twenty-two species (44 per

cent) were each confined to a single depth and 5 were found at all three depths. *Corycaeus*, *Oithona*, and *Oncaea* were found only in the two deeper tows and *Farranula* at all three depths; *Sapphirina* was more numerous in the two deeper tows. The three tows were about equal in length and volume.

STATION 104

May 13, 1929; 20° 12' N, 161° 19' E; bottom depth, 4741 m; 58 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	26.1	25.8	25.3	Density (σ_{tP})	23.1	23.5	23.9
Salinity, ‰	35.1	35.2	35.3	Hydrogen-ion conc. (pH)	8.24	8.24	8.21
Volume of tow, cm ³	64	64	48	Length of tow, miles	1.4	1.3	1.4
<i>Acartia danae</i>	f	..	c	<i>Heterorhabdus papilliger</i>.....	..	..	3
<i>Acrocalanus gibber</i>.....	..	2	..	<i>Labidocera detruncata</i>	c	..	..
<i>gracilis</i>	a	f	c	<i>Lucicutia clausii</i>.....	..	..	c
<i>Calocalanus pavo</i>	2	..	..	<i>flavicornis</i>.....	..	..	a
<i>plumulosus</i>.....	..	f	2	<i>Macrosetella gracilis</i>	1	..	..
<i>Candacia bispinosa</i>	f	..	f	<i>Mecynocera clausi</i>.....	..	..	4
<i>norvegica</i>.....	..	..	f	<i>Megacalanus longicornis</i>.....	..	1	..
<i>simplex</i>.....	..	f	..	<i>Microcalanus pusillus</i>.....	..	2	..
<i>truncata</i>	f	f	f	<i>pygmaeus</i>	2	2	..
<i>varicans</i>.....	..	1	..	<i>Microsetella norvegica</i>	2	..	..
<i>Centropages calaninus</i>	f	f	..	<i>rosea</i>.....	..	c	f
<i>Clausocalanus arcuicornis</i>	f	f	f	<i>Neocalanus gracilis</i>.....	..	c	..
<i>Copilia denticulata</i>	f	c	f	<i>robustior</i>.....	..	c	f
<i>quadrata</i>.....	..	5	5	<i>Oithona attenuata</i>.....	..	f	f
<i>Corycaeus catus</i>.....	..	f	..	<i>similis</i>.....	..	r	f
<i>crassiusculus</i>	c	c	c	<i>spinirostris</i>.....	..	2	..
<i>furcifer</i>.....	..	2	..	<i>Oncaea media</i>	r	..	..
<i>longistylis</i>.....	..	..	f	<i>minuta</i>.....	..	c	c
<i>pumilus</i>	f	..	..	<i>similis</i>.....	..	f	..
<i>speciosus</i>.....	..	f	c	<i>venusta</i>	f	c	c
<i>typicus</i>.....	..	..	r	<i>Paracalanus parvus</i>	f	f	c
<i>Eucalanus attenuatus</i>.....	..	2	..	<i>Pleuromamma gracilis</i>.....	..	..	1
<i>Euchaeta marina</i>.....	..	c	c	<i>Pontellina plumata</i>	1	..	..
<i>Farranula carinata</i>	a	c	a	<i>Pseudocalanus minutus</i>	f	f	c
<i>gibbula</i>	f	..	..	<i>Sapphirina angusta</i>	1	..	..
<i>gracilis</i>	r	..	..	<i>auronitens</i>	c	f	..
<i>rostrata</i>	a	f	f	<i>nigromaculata</i>.....	..	..	4
<i>Haloptilus acutifrons</i>.....	..	..	1	<i>Scolecithrix danae</i>.....	..	f	f
<i>longicornis</i>.....	..	..	f	<i>Undinula darwinii</i>.....	..	c	c

The temperature and hydrogen-ion concentration decreased slightly and the salinity increased a trifle in the 100 meters. Twenty-five species were taken at the surface, 35 in the 50-meter tow, and 34 in the 100-meter tow, an exceptional vertical distribution. Thirty-two species (55 per cent) were each confined to a single depth and 10 were found at all three

depths. *Candacia*, *Corycaeus*, *Farranula*, and *Oncaea* were found at all depths, but *Oithona* did not appear at the surface. *Haloptilus*, *Pleuromamma*, *Heterorhabdus*, and *Lucicutia* were found only at 100 meters. The three tows were of practically the same length, but the volume of each of the two upper tows was one-third larger than that of the 100-meter.

STATION 105

May 15, 1929; 18° 43' N, 156° 16' E; bottom depth, 5576 m; 54 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	26.9	26.8	25.2	Density ($\sigma_{t,p}$)	22.7	22.9	23.8
Salinity, ‰	34.9	34.9	35.1	Hydrogen-ion conc. (pH)	8.23	8.23	8.23
Volume of tow, cm ³	32	35	33	Length of tow, miles	2.0	2.0	2.1

<i>Acartia danae</i>	2	c	c	<i>Lubbockia squillimana</i>.....	..	3	..
<i>Acrocalanus gibber</i>.....	..	f	..	<i>Lucicutia clausii</i>.....	..	..	2
<i>gracilis</i>	f	f	c	<i>flavicornis</i>	1	..	3
<i>longicornis</i>.....	..	5	2	<i>Macrosetella gracilis</i>.....	..	1	..
<i>monachus</i>.....	..	2	2	<i>Microcalanus pusillus</i>.....	..	..	1
<i>Calanus minor</i>.....	..	..	f	<i>pygmaeus</i>.....	..	..	2
<i>Calocalanus pavo</i>.....	..	2	..	<i>Microsetella norvegica</i>.....	..	3	..
<i>Candacia bispinosa</i>.....	..	4	..	<i>rosea</i>.....	..	f	f
<i>norvegica</i>.....	..	2	..	<i>Neocalanus gracilis</i>.....	..	..	f
<i>truncata</i>.....	..	4	f	<i>robustior</i>.....	..	..	f
<i>varicans</i>.....	..	2	1	<i>tenuicornis</i>.....	..	..	2
<i>Canthocalanus pauper</i>.....	..	..	1	<i>Oithona attenuata</i>.....	..	f	f
<i>Centropages calaninus</i>	1	..	..	<i>plumifera</i>.....	..	..	3
<i>Copilia denticulata</i>	1	c	f	<i>similis</i>.....	..	..	f
<i>quadrata</i>.....	..	2	5	<i>Oncaea conifera</i>.....	..	3	..
<i>Corycaeus crassiusculus</i>	c	c	f	<i>media</i>.....	..	f	f
<i>limbatus</i>.....	..	..	r	<i>minuta</i>.....	..	c	c
<i>pumilus</i>.....	..	r	..	<i>venusta</i>.....	..	c	c
<i>speciosus</i>	f	a	c	<i>Paracalanus parvus</i>	f	f	f
<i>typicus</i>.....	..	f	..	<i>Phaenna spinifera</i>.....	..	..	1
<i>Euchaeta marina</i>.....	..	..	a	<i>Pontellina plumata</i>.....	..	1	2
<i>Farranula carinata</i>	a	f	c	<i>Pseudocalanus minutus</i>.....	..	..	c
<i>curta</i>	r	..	..	<i>Sapphirina auronitens</i>	4	3	3
<i>gibbula</i>	c	..	..	<i>nigromaculata</i>.....	..	3	..
<i>rostrata</i>	a	..	c	<i>stellata</i>.....	..	..	1
<i>Haloptilus longicornis</i>.....	..	..	2	<i>Scolecithrix danae</i>.....	..	4	3
<i>Labidocera detruncata</i>	1	..	..	<i>Undinula darwinii</i>.....	..	..	f

The temperature diminished 1.5 in the 100 meters, the salinity increased a trifle, and the hydrogen-ion concentration remained the same. Fourteen species were taken at the surface, 31 in the 50-meter tow, and 38 in the 100-meter tow. Thirty-three species (60 per cent) were each confined to a single depth and 8 were found at all three depths. *Corycaeus*

and *Farranula* were distributed at all three depths. *Candacia*, *Oithona*, and *Oncaea* did not appear at all in the surface tow. *Paracalanus* was evenly divided among the three tows, and *Pseudocalanus* appeared only in the 100-meter tow. Both the length and the volume of the three tows were practically the same.

STATION 106

May 17, 1929; 16° 14' N, 151° 04' E; bottom depth, 5925 m; 68 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.2	26.9	25.5	Density (σ_{tP})	22.6	22.9	23.7
Salinity, o/oo	34.9	34.9	35.0	Hydrogen-ion conc. (pH)	8.23	8.23	8.23
Volume of tow, cm ³	64	64	48	Length of tow, miles	0.5	0.5	0.5

<i>Acartia danae</i>	c	c	f	<i>Haloptilus plumosus</i>.....	..	..	2
<i>Acrocalanus gibber</i>	2	..	..	<i>spiniceps</i>.....	..	..	1
<i>gracilis</i>	a	c	f	<i>Heterorhabdus papilliger</i>.....	..	2	1
<i>longicornis</i>	f	f	..	<i>Labidocera detruncata</i>	1	..	..
<i>monachus</i>.....	..	2	2	<i>Lubbockia squillimana</i>.....	..	1	..
<i>Calanus minor</i>.....	..	f	..	<i>Lucicutia clausii</i>.....	..	..	2
<i>Calocalanus pavo</i>	2	..	2	<i>Mecynocera clausi</i>.....	..	2	..
<i>plumosus</i>.....	..	2	2	<i>Megacalanus longicornis</i>.....	..	1	2
<i>styliremis</i>.....	..	1	..	<i>Microcalanus pusillus</i>.....	..	..	2
<i>Candacia bispinosa</i>.....	..	3	3	<i>pygmaeus</i>.....	..	..	2
<i>longimana</i>.....	..	2	..	<i>Microsetella rosea</i>	f	c	f
<i>simplex</i>.....	..	..	f	<i>Miracia efferata</i>.....	..	1	1
<i>truncata</i>.....	..	f	f	<i>Neocalanus gracilis</i>.....	..	f	c
<i>varicans</i>.....	..	..	f	<i>robustior</i>.....	..	2	f
<i>Canthocalanus pauper</i>	5	..	..	<i>Nesippus</i> sp.	1 ♂	..	..
<i>Centropages calaninus</i>	1	f	..	<i>Oithona attenuata</i>.....	..	f	3
<i>Clausocalanus arcuicornis</i>	2	..	f	<i>plumifera</i>.....	..	..	2
<i>Clytemnestra scutellata</i>.....	..	1	..	<i>similis</i>.....	..	..	f
<i>Copilia denticulata</i>	2	..	f	<i>spinirostris</i>.....	..	f	4
<i>Corycaeus clausi</i>	r	..	..	<i>Oncaea minuta</i>	f	..	..
<i>crassiusculus</i>	f	c	c	<i>venusta</i>	f	c	c
<i>dubius</i>	2	..	..	<i>Onchocalanus nudipes</i> , n. sp. ....	..	..	3
<i>ovalis</i>.....	..	..	3	<i>Paracalanus aculeatus</i>	2	..	..
<i>pacificus</i>.....	..	c	..	<i>parvus</i>	f	..	f
<i>speciosus</i>	f	c	c	<i>Phaenna spinifera</i>.....	..	..	2
<i>Eucalanus attenuatus</i>	1	f	4	<i>Pontella tenuiremis</i>	1	..	..
<i>elongatus</i>.....	..	f	..	<i>Pontellina plumata</i>	4	4	..
<i>Euchaeta acuta</i>.....	..	..	2	<i>Pseudocalanus minutus</i>	f	f	c
<i>marina</i>	1	c	c	<i>Sapphirina auronitens</i>	f	..	2
<i>Farranula carinata</i>	a	a	a	<i>metallina</i>.....	..	..	1
<i>gibbula</i>	f	f	..	<i>niromaculata</i>.....	..	..	1
<i>gracilis</i>	3	..	..	<i>opalina</i>.....	..	2	..
<i>rostrata</i>	a	..	c	<i>Scolecithrix danae</i>.....	..	f	f
<i>Haloptilus longicornis</i>.....	..	..	1	<i>Undinula darwinii</i>.....	..	..	f

The temperature decreased nearly 2° in the 100 meters, the salinity and hydrogen-ion concentration remaining practically the same. Thirty species were found at the surface, 35 in the 50-meter tow, and 45 in the 100-meter tow. Thirty-six species (53 per cent) were each confined to a single depth and 10 were present at all three depths. Although the length of

the three tows was exactly the same, the volume of each of the two upper tows was 33 per cent greater than that of the 100-meter tow. *Corycaeus*, *Farranula*, and *Oncaea* were distributed at all three depths, together with *Eucalanus*, *Euchaeta*, and *Sapphirina*. None of the 4 species of *Oithona* or the 5 species of *Candacia* appeared at the surface.

STATION 107

May 19, 1929; 14° 05' N, 146° 06' E; bottom depth, 4920 m; 61 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	28.4	26.7	25.2	Density (σ_{θ})	21.9	22.2	23.1
Salinity, o/oo	35.0	34.9	34.9	Hydrogen-ion conc. (pH)	8.23	8.23	8.23
Volume of tow, cm ³	32	32	32	Length of tow, miles	1.1	0.5	0.5

<i>Acartia danae</i>.....	..	c	..	<i>Farranula gracilis</i>.....	..	..	3
<i>Acrocalanus gibber</i>.....	..	2	..	<i>rostrata</i>	a	..	f
<i>gracilis</i>	f	f	c	<i>Haloptilus plumosus</i>.....	..	..	3
<i>longicornis</i>.....	..	5	f	<i>spiniceps</i>.....	..	..	5
<i>monachus</i>	2	f	..	<i>Heterorhabdus papilliger</i>.....	..	..	3
<i>Calanus minor</i>.....	..	..	f	<i>Lubbockia squillimana</i>.....	..	..	3
<i>Calocalanus pavo</i>	2	f	f	<i>Lucicutia clausii</i>.....	..	..	c
<i>plumulosus</i>.....	..	2	4	<i>flavicornis</i>.....	..	..	c
<i>Candacia bispinosa</i>.....	..	2	f	<i>Mecynocera clausi</i>.....	..	3	4
<i>simplex</i>.....	..	f	..	<i>Microcalanus pusillus</i>.....	..	1	2
<i>truncata</i>.....	..	c	c	<i>pygmaeus</i>.....	..	2	..
<i>varicans</i>.....	..	..	4	<i>Microsetella rosea</i>	f	f	f
<i>Canthocalanus pauper</i>.....	..	..	3	<i>Neocalanus gracilis</i>.....	..	..	f
<i>Centropages calaninus</i>	1	f	f	<i>robustior</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>.....	..	..	f	<i>Oithona attenuata</i>.....	..	f	f
<i>Clytemnestra scutellata</i>.....	..	1	..	<i>similis</i>.....	..	f	c
<i>Copilia denticulata</i>.....	..	5	..	<i>spinirostris</i>.....	..	..	f
<i>quadrata</i>.....	..	4	2	<i>Oncaea curta</i>.....	..	1	..
<i>vitrea</i>.....	..	2	..	<i>media</i>	2	..	..
<i>Corycaeus agilis</i>	r	..	..	<i>minuta</i>.....	..	c	f
<i>crassiusculus</i>	c	a	c	<i>notopa</i>.....	..	..	2
<i>flaccus</i>.....	..	2	..	<i>venusta</i>.....	..	c	c
<i>lautus</i>.....	..	1	..	<i>Paracalanus parvus</i>	f	f	c
<i>longistylis</i>	1	..	..	<i>Pontellina plumata</i>.....	..	..	2
<i>pacificus</i>.....	..	1	..	<i>Pseudocalanus minutus</i>.....	..	f	f
<i>speciosus</i>	f	c	..	<i>Sapphirina auronitens</i>.....	..	2	..
<i>Euchaeta acuta</i>.....	..	..	f	<i>nigromaculata</i>.....	..	4	2
<i>marina</i>	1	2	c	<i>Scaphocalanus elongatus</i>.....	..	..	1 ♀
<i>Euchirella brevis</i>.....	..	1	1	<i>Scolecithrix danae</i>.....	..	1	f
<i>Farranula carinata</i>	a	a	c	<i>Undinula darwinii</i>.....	..	..	c
<i>gibbula</i>	f	..	f				

The temperature fell 3° in 100 meters, the salinity and hydrogen-ion concentration remaining constant. There were 15 species at the surface, 37 in the 50-meter tow, and 44 in the 100-meter tow. Thirty-four species (56 per cent) were each confined to a single depth and 8 were present at all three depths. Although the surface tow was more than twice the length of either of the other tows, its volume was exactly the

same. *Corycaeus*, *Euchaeta*, *Farranula*, and *Oncaea* were distributed in all three tows, but *Candacia*, *Oithona*, and *Sapphirina* appeared only in the two deeper tows. Here again the paucity of species at the surface compared with those at the other two depths indicates strong light before the tows were taken. The surface tow contained a very large number of 2 of the *Farranula* species.

STATION 108

May 27, 1929; 18° 26' N, 144° 01' E; bottom depth, 3573 m; 57 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	28.4	26.7	25.2	Density (σ_{tP})	22.2	23.0	23.7
Salinity, o/oo	35.0	34.9	34.9	Hydrogen-ion conc. (pH)	8.25	8.25	8.23
Volume of tow, cm ³	32	32	32	Length of tow, miles	0.8	1.0	1.1

<i>Acrocalanus gibber</i>.....	..	..	2	<i>Heterorhabdus papilliger</i>.....	..	..	5
<i>gracilis</i>.....	..	f	..	<i>Lubbockia squillimana</i>.....	..	..	2
<i>Aetideus armatus</i>.....	..	..	2	<i>Lucicutia clausii</i>.....	..	..	c
<i>Calanus minor</i>	1	..	f	<i>flavicornis</i>.....	..	..	c
<i>Calocalanus pavo</i>.....	..	5	..	<i>Macrosetella gracilis</i>	2	2	..
<i>Candacia bispinosa</i>.....	..	5	f	<i>Mecynocera clausi</i>.....	..	..	3
<i>longimana</i>.....	..	..	2	<i>Megacalanus longicornis</i>.....	..	..	1
<i>simplex</i>.....	..	4	4	<i>Microcalanus pusillus</i>.....	..	..	3
<i>truncata</i>.....	..	c	f	<i>pygmaeus</i>	1	..	1
<i>varicans</i>.....	..	..	2	<i>Microsetella rosea</i>	2	..	f
<i>Canthocalanus pauper</i>	3	..	..	<i>Neocalanus gracilis</i>.....	..	f	f
<i>Copilia denticulata</i>	1	..	f	<i>robustior</i>.....	..	2	f
<i>quadrata</i>.....	..	5	f	<i>Oithona attenuata</i>.....	..	4	f
<i>recta</i>.....	..	..	2	<i>plumifera</i>.....	..	2	..
<i>vitrea</i>.....	..	2	f	<i>similis</i>.....	..	f	f
<i>Corycaeus agilis</i>.....	..	2	..	<i>spinirostris</i>.....	..	..	f
<i>catus</i>	2	..	..	<i>Oncaea conifera</i>.....	..	..	3
<i>crassiusculus</i>	3	c	c	<i>media</i>.....	..	f	..
<i>furcifer</i>.....	..	3	..	<i>minuta</i>	3	..	c
<i>limbatus</i>.....	..	..	r	<i>venusta</i>.....	..	c	c
<i>ovalis</i>	1	..	..	<i>Paracalanus parvus</i>	2	f	f
<i>speciosus</i>	2	c	c	<i>Phaenna spinifera</i>.....	..	1	..
<i>Eucalanus attenuatus</i>.....	..	3	3	<i>Pontellina plumata</i>.....	..	..	1
<i>Euchaeta marina</i>.....	..	3	f	<i>Pseudocalanus minutus</i>	3	f	..
<i>Farranula carinata</i>	f	..	c	<i>Sapphirina nigromaculata</i>.....	..	..	2
<i>concinna</i>	2	..	..	<i>stellata</i>.....	..	..	2
<i>gibbula</i>.....	..	1	f	<i>Scolecithrix danae</i>.....	..	1	..
<i>rostrata</i>	f	..	f	<i>Undinula darwinii</i>.....	..	f	f
<i>Haloptilus longicornis</i>.....	..	..	4				

Again the high surface temperature fell 3° in 100 meters, but the salinity and hydrogen-ion concentration remained nearly constant. Sixteen species were taken at the surface, 27 in the 50-meter tow, and 43 in the 100-meter tow. Thirty-one species (54 per cent) were each confined to a single tow

and only 3 were found in all three tows. *Corycaeus*, *Farranula*, and *Oncaea* appeared in all three tows, but *Candacia*, *Oithona*, and *Sapphirina* were not present at the surface. The disparity in vertical distribution is slightly less than at the previous station, but still remains quite large.

HARBOR OF APRA, GUAM

May 22, 1929; 14° 00' N, 148° 00' E; 14 species

<i>Acrocalanus gracilis</i>	2	<i>Neocalanus tenuicornis</i>	2	<i>Paracalanus parvus</i>	a
<i>Farranula gibbula</i>	f	<i>Oithona attenuata</i>	1	<i>Temora discaudata</i>	1
<i>rostrata</i>	r	<i>similis</i>	2	<i>Undinula darwinii</i>	f
<i>Labidocera detruncata</i>	f	<i>Oncaea minuta</i>	r	<i>vulgaris</i>	a
<i>Microsetella rosea</i>	1	<i>venusta</i>	2		

Although this surface tow was made in the harbor, the copepods here do not differ at all from those in the open

ocean. Evidently such littoral forms as may live around the coasts of these islands do not venture far from shore.

STATION 109

May 29, 1929; 23° 22' N, 144° 08' E; bottom depth, 5252 m; 90 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.4	23.1	19.4	Density (σ_{tP})	22.6	24.1	25.2
Salinity, o/oo	35.0	34.9	34.8	Hydrogen-ion conc. (pH)	8.23	8.23	8.22
Volume of tow, cm ³	32	64	128	Length of tow, miles	1.4	1.5	1.5

<i>Acartia danae</i>.....	..	c	a	<i>Heterorhabdus spinifrons</i>.....	..	..	2
<i>Acrocalanus gibber</i>	f	..	5	<i>Labidocera detruncata</i>	f	..	..
<i>gracilis</i>	f	f	c	<i>Lubbockia squillimana</i>.....	..	3	c
<i>longicornis</i>	r	f	..	<i>Lucicutia clausii</i>.....	..	..	c
<i>Aetideus armatus</i>.....	..	..	3	<i>flavicornis</i>.....	..	..	c
<i>Calanus minor</i>.....	..	f	f	<i>longicornis</i>.....	..	2	..
<i>Calocalanus pavo</i>.....	..	4	f	<i>Macrosetella gracilis</i>	f	3	2
<i>plumulosus</i>.....	..	2	3	<i>oculata</i>.....	..	..	1
<i>styliremis</i>.....	..	..	2	<i>Mecynocera clausi</i>.....	..	5	c
<i>Candacia bispinosa</i>.....	..	f	2	<i>Microcalanus pusillus</i>.....	..	..	4
<i>simplex</i>.....	..	f	f	<i>pygmaeus</i>.....	..	f	4
<i>truncata</i>.....	..	c	f	<i>Microsetella rosea</i>.....	..	f	c
<i>varicans</i>.....	..	2	..	<i>Monstrilla inserta</i>.....	..	2 ♀	..
<i>Canthocalanus pauper</i>.....	..	..	4	<i>Neocalanus gracilis</i>.....	..	a	a
<i>Centropages calaninus</i>	2	2	..	<i>robustior</i>.....	..	f	c
<i>elongatus</i>.....	..	2	..	<i>tenuicornis</i>.....	..	..	c
<i>Clausocalanus arcuicornis</i>	2	f	c	<i>Oithona attenuata</i>.....	..	f	..
<i>furcatus</i>.....	..	r	..	<i>plumifera</i>.....	..	2	f
<i>Clytemnestra scutellata</i>.....	..	..	4	<i>similis</i>.....	..	f	c
<i>Copilia denticulata</i>.....	..	f	..	<i>spinirostris</i>.....	..	f	f
<i>mirabilis</i>.....	..	3	..	<i>Oithonina nana</i>.....	..	..	2
<i>quadrata</i>.....	..	2	f	<i>Oncaea conifera</i>.....	..	3	..
<i>recta</i>.....	..	4	5	<i>curta</i>.....	..	r	..
<i>vitrea</i>.....	..	..	2	<i>media</i>	r	..	..
<i>Corycaeus agilis</i>.....	..	r	..	<i>minuta</i>	f	a	a
<i>crassiusculus</i>	f	a	c	<i>similis</i>	r	..	..
<i>dubius</i>.....	..	r	..	<i>tenella</i>.....	..	..	r
<i>flaccus</i>.....	..	1	..	<i>venusta</i>	c	a	a
<i>lautus</i>.....	..	..	r	<i>Onchocalanus nudipes, n. sp.</i>	3	..	..
<i>longistylis</i>.....	..	..	f	<i>Paracalanus parvus</i>.....	..	c	c
<i>pumilus</i>	r	..	..	<i>pygmaeus</i>.....	..	..	f
<i>speciosus</i>.....	..	c	c	<i>Phaenna spinifera</i>.....	..	f	..
<i>typicus</i>.....	..	r	..	<i>Pleuromamma abdominalis</i>.....	..	..	1
<i>Euaetideus giesbrechti</i>.....	..	1	..	<i>Pontella lobiancoi</i>	2 ♂	..	..
<i>Eucalanus attenuatus</i>.....	..	f	f	<i>Pontellina plumata</i>.....	..	1	..
<i>elongatus</i>.....	..	2	..	<i>Pseudocalanus minutus</i>.....	..	c	c
<i>Euchaeta acuta</i>.....	..	2	..	<i>Sapphirina angusta</i>.....	..	2	..
<i>marina</i>.....	..	a	f	<i>auronitens</i>	1	..	5
<i>Euchirella brevis</i>.....	..	2	1	<i>metallina</i>.....	..	..	f
<i>Farranula carinata</i>	a	c	..	<i>nigromaculata</i>.....	..	3	..
<i>gibbula</i>	c	..	..	<i>stellata</i>.....	..	..	3
<i>gracilis</i>	f	..	..	<i>Scolecithricella bradyi</i>.....	..	..	4
<i>rostrata</i>	a	f	f	<i>Scolecithrix danae</i>.....	..	f	..
<i>Haloptilus longicornis</i>.....	..	..	f	<i>Undinula caroli</i>.....	..	..	2
<i>Heterorhabdus papilliger</i>.....	..	..	f	<i>darwini</i>.....	..	c	c

The high surface temperature fell 4° at the 50-meter depth and 4° more at the 100-meter depth; the salinity and hydrogen-ion concentration remained almost constant. There were 20 species in the surface tow, 57 in the 50-meter tow, and 57 in the 100-meter tow. Fifty-three species (60 per cent) were each confined to a single depth and 7 were present at all three depths. The length of the three tows was almost

exactly the same, but the 100-meter tow had twice the volume of the 50-meter tow and four times that of the surface tow. *Corycaeus*, *Farranula*, and *Oncaea* were distributed at all three depths; *Candacia*, *Eucalanus*, *Euchaeta*, and *Oithona* did not appear in the surface tow. A solitary specimen of one of the 5 *Sapphirina* species appeared at the surface, but all the others were confined to the deeper tows. The 50-meter

tow contains one of the two records of *Monstrilla inserta* for the entire cruise, 2 females. Two young males of a *Pontella* species (probably *lobiancoi*), whose fifth legs were not fully developed, were captured in the surface tow. Again the small

number of both species and specimens (except those of *Farranula*) found at the surface indicates that a strong downward migration of the copepods had been in progress before the towing.

STATION 110

May 31, 1929; 26° 20' N, 144° 24' E; bottom depth, 3036 m; 55 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	23.8	18.3	17.9	Density (σ_{tP})	23.4	25.2	25.5
Salinity, o/oo	34.7	34.7	34.7	Hydrogen-ion conc. (pH)	8.18	8.18	8.14
Volume of tow, cm ³	48	48	48	Length of tow, miles	0.5	0.5	0.5

<i>Acartia danae</i>.....	..	c	f	<i>Lucicutia clausii</i>.....	..	4	c
<i>Acrocalanus gracilis</i>	a	c	c	<i>flavicornis</i>.....	..	c	a
<i>Aetideus armatus</i>.....	..	..	4	<i>Macrosetella gracilis</i>	5	..	..
<i>Calanus minor</i>.....	..	c	c	<i>Mecynocera clausi</i>.....	..	r	f
<i>propinquus</i>	1	..	..	<i>Megacalanus longicornis</i>.....	..	1	1
<i>Candacia bispinosa</i>.....	..	1	..	<i>Microcalanus pygmaeus</i>.....	..	r	r
<i>simplex</i>.....	..	r	..	<i>Neocalanus gracilis</i>.....	..	c	a
<i>Canthocalanus pauper</i>.....	..	f	..	<i>robustior</i>.....	..	c	f
<i>Clausocalanus arcuicornis</i>	4	f	c	<i>tenuicornis</i>.....	..	2	f
<i>furcatus</i>.....	..	..	3	<i>Oithona similis</i>	3	f	f
<i>Clytemnestra scutellata</i>.....	..	..	2	<i>spinirostris</i>.....	..	..	f
<i>Copilia mirabilis</i>.....	..	1	..	<i>Oncaea conifera</i>.....	..	3	..
<i>Corycaeus catus</i>.....	..	r	..	<i>media</i>	f	..	..
<i>crassiusculus</i>	f	r	a	<i>minuta</i>.....	..	a	c
<i>limbatus</i>	3	..	..	<i>notopa</i>.....	..	..	2
<i>pacificus</i>.....	..	2	..	<i>venusta</i>	f	a	a
<i>pumilus</i>.....	..	f	..	<i>Pandarus satyrus</i> on a shark	..	..	..
<i>typicus</i>.....	..	r	..	<i>Paracalanus aculeatus</i>.....	..	4	..
<i>Eucalanus attenuatus</i>.....	..	2	1	<i>parvus</i>	f	c	c
<i>Euchaeta marina</i>.....	..	..	2	<i>pygmaeus</i>.....	..	..	r
<i>Farranula carinata</i>.....	..	..	..	<i>Phaenna spinifera</i>.....	..	2	5
<i>gibbula</i>	f	..	..	<i>Pseudocalanus minutus</i>.....	..	c	c
<i>rostrata</i>	f	..	..	<i>Rhincalanus cornutus</i>.....	..	1	..
<i>Haloptilus ornatus, juv.</i>.....	..	..	1 ♂	<i>Sapphirina angusta</i>.....	..	2	..
<i>Heterorhabdus papilliger</i>.....	..	..	f	<i>Scolecithricella bradyi</i>.....	..	..	2
<i>spinifrons</i>.....	..	..	2	<i>Scolecithrix danae</i>.....	..	..	4
<i>Labidocera detruncata</i>	f	..	..	<i>Undinula darwinii</i>.....	..	a	a
<i>Lubbockia squillimana</i>.....	..	..	1				

The moderate surface temperature fell 6° in the 100 meters, the salinity and hydrogen-ion concentration remaining practically the same. There were 14 species in the surface tow, 32 in the 50-meter tow, and 33 in the 100-meter tow. Thirty-three species (60 per cent) were each confined to a single depth and 6 were present at all three depths. *Corycaeus*,

Oithona, and *Oncaea* were distributed at all three depths, but the 3 *Farranula* species were confined to the surface tow. *Candacia* and *Sapphirina* appeared only in the 50-meter tow. Fifteen specimens of *Pandarus satyrus*, including both sexes, were taken from a shark captured at the surface and constitute the only record for this parasitic copepod.

BETWEEN STATIONS 110 AND 111

June 2, 1929; 30° 08' N, 143° 56' E; 6 species

<i>Acartia danae</i>	a	<i>Corycaeus crassiusculus</i>	3	<i>Labidocera detruncata</i>	1
<i>Acrocalanus gracilis</i>	a	<i>longistylis</i>	1	<i>Pleuromamma gracilis</i>	2

This surface tow yielded only 7 specimens besides *Acartia* and *Acrocalanus*, both of which were quite abundant.

STATION 111

June 3, 1929; 31° 00' N, 144° 16' E; bottom depth, 6008 m; 37 species

Depth of tow, m	50	100	Depth of tow, m	50	100
Temperature, °C	19.3	18.1	Density (σ_{tP})	24.8	25.5
Salinity, o/oo	34.5	34.7	Hydrogen-ion concentration (pH)	8.18	8.13
Volume of tow, cm ³	32	32	Length of tow, miles	1.8	1.9

<i>Acartia danae</i>	c	2	<i>Euchaeta marina</i>.....	..	1
<i>Acrocalanus gibber</i>	2	..	<i>Heterorhabdus papilliger</i>.....	..	2
<i>gracilis</i>	c	c	<i>Lucicutia clausii</i>.....	..	f
<i>Calanus minor</i>	c	..	<i>Mecynocera clausi</i>	3	5
<i>Calocalanus plumulosus</i>.....	..	1	<i>Microcalanus pusillus</i>.....	..	1
<i>Candacia curta</i>	1	..	<i>pygmaeus</i>	2	..
<i>simplex</i>.....	..	1	<i>Neocalanus gracilis</i>	1	f
<i>Canthocalanus pauper</i>	f	2	<i>tenuicornis</i>.....	..	1
<i>Clausocalanus arcuicornis</i>	f	2	<i>Oithona similis</i>	c	f
<i>Clytemnestra scutellata</i>.....	..	1	<i>Oncaea media</i>	f	..
<i>Corycaeus crassiusculus</i>	c	..	<i>minuta</i>	f	f
<i>flaccus</i>	f	..	<i>similis</i>	2	..
<i>longistylis</i>	2	..	<i>venusta</i>	c	c
<i>ovalis</i>	2	..	<i>Paracalanus parvus</i>	c	c
<i>pumilus</i>.....	..	r	<i>pygmaeus</i>.....	..	3
<i>speciosus</i>	2	..	<i>Pseudocalanus minutus</i>	c	c
<i>typicus</i>.....	..	r	<i>Scolecithricella bradyi</i>.....	..	2
<i>Eucalanus elongatus</i>	1	..	<i>Undinula darwinii</i>	f	f
<i>Euchaeta acuta</i>.....	..	1			

The temperature and hydrogen-ion concentration diminished a little at the 100-meter depth, and the salinity increased. There were 24 species in the 50-meter tow and 25 in the 100-meter tow. Twenty-five species (70 per cent) each

appeared at a single depth and 12 at both depths. *Corycaeus* and *Oncaea* were more numerous in the 50-meter tow; *Farranula* did not appear in either tow. Probably *Farranula* would have been present in the lost surface tow as at station 110.

STATION 112

June 5, 1929; 33° 51' N, 141° 15' E; bottom depth, 3931 m; 85 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	23.2	21.7	19.8	Density (σ_{tP})	23.5	24.2	25.0
Salinity, o/oo	34.6	34.6	34.7	Hydrogen-ion conc. (pH)	8.22	8.22	8.20
Volume of tow, cm ³	96	80	80	Length of tow, miles	2.7	2.4	2.6

<i>Acartia danae</i>.....	..	c	f	<i>Lucicutia clausii</i>.....	..	2	..
<i>Acrocalanus gibber</i>	a	a	c	<i>flavicornis</i>.....	..	..	f
<i>gracilis</i>	c	..	f	<i>Macrosetella gracilis</i>	3	2	..
<i>longicornis</i>.....	..	2	2	<i>oculata</i>	1	..	..
<i>Aetideus armatus</i>.....	..	..	3	<i>Mecynocera clausi</i>.....	..	a	a
<i>Calanus minor</i>	c	a	c	<i>Megacalanus longicornis</i>.....	..	3	..
<i>propinquus</i>	2	..	..	<i>Microcalanus pusillus</i>.....	..	2	..
<i>Calocalanus pavo</i>	5	f	..	<i>pygmaeus</i>	f	5	3
<i>plumulosus</i>	1	..	2	<i>Microsetella rosea</i>	1	r	..
<i>styliremis</i>	1	1	..	<i>Miracia efferata</i>	1	1	..
<i>Candacia aethiopica</i>.....	..	1	..	<i>Monstrilla inserta</i>.....	..	5 ♀	..
<i>bipinnata</i>.....	..	2	..	<i>Neocalanus gracilis</i>	2	f	a
<i>bispinosa</i>.....	..	f	..	<i>robustior</i>.....	..	f	f
<i>curta</i>	2	4	..	<i>tenuicornis</i>	1	2	c
<i>norvegica</i>.....	..	2	..	<i>Oithona attenuata</i>.....	..	f	4
<i>simplex</i>.....	..	2	..	<i>plumifera</i>.....	..	f	c
<i>truncata</i>.....	..	f	..	<i>similis</i>.....	..	c	..
<i>Canthocalanus pauper</i>	f	f	4	<i>spinirostris</i>.....	..	f	..
<i>Centropages calaninus</i>	4	..	..	<i>Oncaea curta</i>.....	..	2	..
<i>Clausocalanus arcuicornis</i>	c	c	c	<i>media</i>	f	..	..
<i>furcatus</i>.....	..	..	f	<i>minuta</i>	c	c	c
<i>Clytemnestra scutellata</i>.....	..	2	..	<i>similis</i>.....	..	..	f
<i>Copilia denticulata</i>	2	..	..	<i>tenella</i>	r	..	..
<i>mirabilis</i>	2	..	..	<i>venusta</i>	c	c	c
<i>recta</i>.....	..	..	3	<i>Paracalanus aculeatus</i>	r	..	..
<i>Corycaeus crassiusculus</i>	c	f	c	<i>parvus</i>	f	c	c
<i>furcifer</i>	2	..	..	<i>Pleuromamma gracilis</i>.....	..	..	2
<i>lubbockii</i>	1	..	..	<i>Pontellina plumata</i>	f	..	..
<i>pumilus</i>.....	..	f	r	<i>Pseudocalanus minutus</i>	c	c	c
<i>speciosus</i>	f	4	2	<i>Rhincalanus cornutus</i>.....	..	4	..
<i>typicus</i>.....	..	4	r	<i>nasutus</i>.....	..	2	..
<i>Danodes plumata</i> , n. gen. and n. sp.	3 ♀	..	..	<i>Sapphirina angusta</i>.....	..	2	..
<i>Eucalanus attenuatus</i>.....	..	c	f	<i>auronitens</i>	3	..	1
<i>crassus</i>.....	..	4	3	<i>nigromaculata</i>.....	..	1	..
<i>elongatus</i>.....	..	c	f	<i>opalina</i>.....	..	2	2
<i>Euchaeta acuta</i>.....	..	3	..	<i>Scolecithricella bradyi</i>.....	..	3	f
<i>marina</i>	2	f	f	<i>Scolecithrix danae</i>.....	..	c	f
<i>Farranula carinata</i>	c	..	..	<i>Temora discaudata</i>	f	..	..
<i>concinna</i>.....	..	2	..	<i>Undeuchaeta plumosa</i>.....	..	..	1
<i>gibbula</i>	f	..	f	<i>Undinula caroli</i>.....	..	f	..
<i>rostrata</i>	c	..	f	<i>darwinii</i>	f	a	a
<i>Heterorhabdus papilliger</i>.....	..	2	2	<i>vulgaris</i>.....	..	2	..
<i>Labidocera detruncata</i>	5	..	..		

The moderate surface temperature fell 3.5 in 100 meters, the salinity and hydrogen-ion concentration remaining nearly constant. There were 41 species in the surface tow, 57 in the 50-meter tow, and 41 in the 100-meter tow. Forty-two species (50 per cent) were each confined to a single tow and 15 were

present in all three tows. *Corycaeus*, *Farranula*, and *Oncaea* were well distributed in all three tows, but *Oithona* did not appear in the surface tow and *Candacia* was confined to the 50-meter tow with one exception. The 50-meter tow contains the second of two records for *Monstrilla inserta*, 5 females.

STATION 113

June 25, 1929; 34° 44' N, 141° 04' E; bottom depth, 2911 m; 93 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	24.1	23.7	21.5	Density (σ_{tP})	23.2	23.6	24.5
Salinity, o/oo	34.5	34.5	34.6	Hydrogen-ion conc. (pH)	8.25	8.25	8.23
Volume of tow, cm ³	32	64	128	Length of tow, miles	1.7	1.6	1.7

<i>Acartia danae</i>.....	..	2	f	<i>Haloptilus spiniceps</i>.....	..	1	..
<i>negligens</i>	3	..	..	<i>Heterorhabdus papilliger</i>.....	..	2	f
<i>Acrocalanus gibber</i>	c	r	f	<i>Labidocera detruncata</i>	c	..	..
<i>gracilis</i>	a	c	c	<i>Lubbockia aculeata</i>.....	..	..	f
<i>longicornis</i>	f	..	f	<i>squillimana</i>.....	..	c	..
<i>monachus</i>.....	..	3	f	<i>Lucicutia clausii</i>.....	..	a	..
<i>Aetideus armatus</i>.....	..	a	..	<i>flavicornis</i>.....	..	c	..
<i>Anomalocera patersonii</i>.....	..	..	1	<i>Macrosetella gracilis</i>	4	3	2
<i>Calanus minor</i>	c	c	c	<i>oculata</i>	1	..	..
<i>propinquus</i>.....	..	..	2	<i>Mecynocera clausi</i>.....	..	c	a
<i>Calocalanus pavo</i>.....	..	2	c	<i>Megacalanus longicornis</i>.....	..	1	2
<i>plumulosus</i>.....	..	2	3	<i>Microcalanus pusillus</i>.....	..	2	4
<i>styliremis</i>.....	..	1	..	<i>pygmaeus</i>.....	..	..	f
<i>Candacia bipinnata</i>.....	..	..	1	<i>Microsetella norvegica</i>	2	..	..
<i>bispinosa</i>.....	..	4	5	<i>rosea</i>.....	..	f	f
<i>curta</i>.....	..	2	..	<i>Miracia efferata</i>	1	..	..
<i>longimana</i>.....	..	..	2	<i>Neocalanus gracilis</i>.....	..	c	f
<i>norvegica</i>.....	..	..	2	<i>robustior</i>.....	..	f	f
<i>pachydactyla</i>.....	..	..	1	<i>tenuicornis</i>.....	..	c	f
<i>simplex</i>	2	f	f	<i>Oithona attenuata</i>.....	..	..	f
<i>truncata</i>.....	..	f	c	<i>plumifera</i>.....	..	..	f
<i>Canthocalanus pauper</i>.....	..	4	f	<i>similis</i>.....	..	c	..
<i>Centropages calaninus</i>	2	..	f	<i>spirostris</i>.....	..	f	c
<i>Clausocalanus arcuicornis</i>	c	f	c	<i>Oncaea conifera</i>.....	..	2	..
<i>Copilia denticulata</i>.....	..	..	4	<i>media</i>	r	..	..
<i>mirabilis</i>.....	..	..	2	<i>mediterranea</i>.....	..	1	..
<i>recta</i>.....	..	..	3	<i>minuta</i>	c	c	c
<i>Corycaeus catus</i>	r	..	..	<i>notopa</i>.....	..	4	..
<i>crassiusculus</i>	c	c	c	<i>similis</i>.....	..	f	..
<i>dubius</i>	3	..	..	<i>tenella</i>.....	..	2	..
<i>lautus</i>.....	..	4	..	<i>venusta</i>	c	a	a
<i>longistylis</i>.....	..	..	2	<i>Pachos tuberosum</i>.....	..	..	4
<i>robustus</i>.....	..	1	..	<i>Pachyptilus abbreviatus</i>.....	..	1 ♀	..
<i>speciosus</i>.....	..	f	f	<i>Paracalanus parvus</i>.....	..	f	c
<i>typicus</i>.....	..	..	4	<i>pygmaeus</i>.....	..	2	f
<i>Euaetideus giesbrechti</i>.....	..	..	3	<i>Pseudocalanus minutus</i>	c	f	c
<i>Eucalanus attenuatus</i>.....	..	f	c	<i>Rhincalanus cornutus</i>.....	..	..	2
<i>crassus</i>.....	..	..	2	<i>nasutus</i>.....	..	1	..
<i>elongatus</i>.....	..	..	4	<i>Sapphirina angusta</i>	2	..	..
<i>Euchaeta acuta</i>.....	..	2	..	<i>auronitens</i>.....	..	1	..
<i>marina</i>.....	..	f	c	<i>metallina</i>.....	..	r	..
<i>Farranula carinata</i>	a	..	..	<i>Scolecithricella bradyi</i>.....	..	f	..
<i>curta</i>.....	..	..	r	<i>Scolecithrix danae</i>.....	..	2	c
<i>gibbula</i>	f	f	..	<i>Undinula caroli</i>.....	..	..	f
<i>rostrata</i>	a	f	f	<i>darwinii</i>	2	f	c
<i>Haloptilus longicornis</i>.....	..	4	..	<i>vulgaris</i>.....	..	..	f
<i>ornatus</i>.....	..	..	1				

The moderate surface temperature fell 2.5 in the 100 meters, the salinity and hydrogen-ion concentration remaining nearly constant. Twenty-five species appeared in the surface tow, 56 in the 50-meter tow, and 60 in the 100-meter tow. Fifty-five species (60 per cent) were each confined to a

single tow and 12 were present in all three tows. *Corycaeus*, *Farranula*, and *Oncaea* were distributed at all three depths, but *Candacia* (except *simplex*) and *Oithona* did not appear in the surface tow, and *Sapphirina* did not appear in the 100-meter tow. The three tows were all of about the same length,

but the volume of the 100-meter tow was four times that of the surface tow and twice that of the 50-meter tow. The three genera *Candacia*, *Corycaeus*, and *Oncaea* each present 8 species and when combined constitute more than a quarter of the species total for the station. Again there is good

evidence that the reaction to light within a copepod genus is specific rather than generic. Two of the 8 species of *Corycaeus* were confined to the surface tow, 2 to the 50-meter tow, and 2 to the 100-meter tow, a seventh was equally distributed in two tows, and the eighth in all three tows.

STATION 114

June 27, 1929; 36° 38' N, 143° 34' E; bottom depth, 6630 m; 66 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	19.9	16.2	13.0	Density (σ_{tP})	24.2	25.6	26.4
Salinity, o/oo	34.3	34.5	34.4	Hydrogen-ion conc. (pH)	8.15	8.08	8.00
Volume of tow, cm ³	32	80	48	Length of tow, miles	0.8	0.8	0.8

<i>Acartia danae</i>	c	..	..	<i>Lucicutia flavicornis</i>.....	..	..	c
<i>Acrocalanus gibber</i>.....	..	3	f	<i>Megacalanus longicornis</i>.....	..	2	..
<i>gracilis</i>	1	f	c	<i>princeps</i>.....	..	2	2
<i>Aetideus armatus</i>.....	..	..	f	<i>Microcalanus pusillus</i>.....	..	..	2
<i>Calanus helgolandicus</i>.....	..	2	..	<i>pygmaeus</i>.....	..	..	f
<i>minor</i>.....	..	..	f	<i>Microsetella rosea</i>.....	..	..	f
<i>propinquus</i>.....	..	..	f	<i>Miracia efferata</i>.....	..	2	..
<i>Candacia armata</i>.....	..	..	2	<i>Neocalanus gracilis</i>.....	..	c	..
<i>bipinnata</i>.....	..	2	..	<i>robustior</i>.....	..	f	f
<i>simplex</i>.....	..	..	4	<i>tenuicornis</i>.....	..	c	c
<i>varicans</i>.....	..	1	2	<i>Oithona attenuata</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>	1	f	c	<i>plumifera</i>.....	..	f	..
<i>Corycaeus catus</i>	r	..	..	<i>similis</i>.....	..	c	c
<i>crassiusculus</i>	f	c	c	<i>spirostris</i>.....	..	f	..
<i>furcifer</i>.....	..	..	r	<i>Oncaea confera</i>.....	..	..	3
<i>pumilus</i>.....	..	..	r	<i>curvata</i>.....	..	..	1
<i>speciosus</i>.....	..	..	1	<i>media</i>.....	..	..	f
<i>Eucalanus attenuatus</i>.....	..	f	f	<i>mediterranea</i>.....	..	..	3
<i>crassus</i>.....	..	2	4	<i>minuta</i>.....	..	c	c
<i>elongatus</i>.....	..	3	4	<i>tenella</i>.....	..	..	4
<i>Euchaeta acuta</i>.....	..	3	c	<i>venusta</i>.....	..	..	a
<i>marina</i>.....	..	2	f	<i>Paracalanus parvus</i>	f	f	c
<i>Euchirella curticauda</i>	2	2	..	<i>pygmaeus</i>.....	..	f	..
<i>intermedia</i>.....	..	1	..	<i>Pleuromamma gracilis</i>.....	..	..	1
<i>Farranula carinata</i>	1	..	3	<i>Pseudocalanus minutus</i>	2	c	c
<i>gibbula</i>	2	..	..	<i>Rhincalanus nasutus</i>.....	..	2	2
<i>rostrata</i>	2	..	..	<i>Sapphirina nigromaculata</i>.....	..	2	..
<i>Haloptilus acutifrons</i>.....	..	..	1	<i>stellata</i>	2	..	..
<i>Heterorhabdus papilliger</i>.....	..	..	c	<i>Scolecithricella bradyi</i>.....	..	4	4
<i>spinifrons</i>.....	..	..	1	<i>marginata</i>.....	..	3	..
<i>Labidocera detruncata</i>	3	..	..	<i>Scolecithrix danae</i>.....	..	f	..
<i>Lubbockia aculeata</i>.....	..	2	..	<i>Temora discaudata</i>.....	..	1	..
<i>Lucicutia clausii</i>.....	..	..	c	<i>Undinula darwinii</i>.....	..	f	f

The temperature was low at the surface and fell 7° in the 100 meters, but the salinity and hydrogen-ion concentration varied little. Thirteen species were taken in the surface tow, 35 in the 50-meter tow, and 45 in the 100-meter tow. Forty-four species (67 per cent) were each confined to a single depth and only 5 appeared at all three depths. *Corycaeus* was found in all three tows, but *Farranula* was not present in the 50-meter tow and *Eucalanus*, *Euchaeta*, *Oithona*, and

Oncaea were not present at the surface, the 7 species of the latter, with one exception, being confined to the 100-meter tow. The three tows were of exactly the same length but differed considerably in volume, that of the surface tow being the smallest and of the 50-meter tow the largest. The unequal vertical distribution again bears witness to a strong downward migration on the part of a large proportion of the species.

STATION 115

June 29, 1929; 37° 40' N, 145° 26' E; bottom depth, 5396 m; 36 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	20.5	17.5	15.6	Density (σ_t)	24.3	25.3	26.0
Salinity, o/oo	34.5	34.6	34.6	Hydrogen-ion conc. (pH)	8.19	8.12	8.08
Volume of tow, cm ³	112	128	128	Length of tow, miles	0.7	0.7	0.7

<i>Acartia danae</i>	1	..	..	<i>Microcalanus pygmaeus</i>.....	..	2	f
<i>Acrocalanus gracilis</i>	f	f	f	<i>Neocalanus gracilis</i>.....	..	f	..
<i>Aetideus armatus</i>.....	..	2	f	<i>tenuicornis</i>	1	..	f
<i>Candacia armata</i>.....	..	..	2	<i>Oithona similis</i>	2	2	f
<i>simplex</i>.....	..	..	4	<i>spinirostris</i>.....	..	..	c
<i>tenuimana</i>.....	..	..	1 ♀	<i>Oncaea media</i>.....	..	..	f
<i>Chiridius poppei</i> , juv.....	..	1 ♂	..	<i>mediterranea</i>.....	..	3	..
<i>Clausocalanus arcuicornis</i>.....	..	f	c	<i>minuta</i>	2	f	f
<i>Corycaeus crassiusculus</i>.....	..	c	2	<i>venusta</i>	1	f	c
<i>pumilus</i>.....	..	f	..	<i>Paracalanus parvus</i>	a	c	c
<i>Eucalanus crassus</i>.....	..	1	2	<i>pygmaeus</i>.....	..	2	..
<i>Euchaeta acuta</i>.....	..	4	f	<i>Pseudocalanus minutus</i>	f	c	c
<i>Farranula rostrata</i>	2	..	..	<i>Sapphirina auronitens</i>.....	..	1	2
<i>Haloptilus spiniceps</i>.....	..	1	..	<i>opalina</i>.....	..	..	2
<i>Heterorhabdus papilliger</i>.....	..	..	f	<i>Scolecithricella bradyi</i>.....	..	1	2
<i>Labidocera detruncata</i>	f	..	..	<i>Scolecithrix danae</i>.....	..	2	f
<i>Lubbockia squillimana</i>	1	..	..	<i>Temora discaudata</i>.....	..	1	2
<i>Lucicutia flavicornis</i>.....	..	..	f	<i>stylifera</i>	5	..	..

The temperature was moderate at the surface and fell 3° at 50 meters and 2° more at 100 meters; the salinity and hydrogen-ion concentration remained nearly constant. There were 12 species in the surface tow, 22 in the 50-meter tow, and 25 in the 100-meter tow. Nineteen species (53 per cent) were each confined to a single tow and 6 were present in all three tows. *Corycaeus* was confined to the two deeper tows,

Farranula appeared only in the surface tow and was reduced to a single species, *Oithona* and *Oncaea* were distributed in all three tows; *Candacia* was confined to the 100-meter tow, and this is the only record for the species *tenuimana*. In the surface tow *Paracalanus parvus* was especially abundant and constituted at least 90 per cent of the copepods. The 50-meter and 100-meter tows were badly choked with diatoms.

BETWEEN STATIONS 115 AND 116

June 30, 1929; 38° 22' N, 147° 20' E; 5 species

<i>Acartia danae</i>	c	<i>Oithona similis</i>	2	<i>Pseudocalanus minutus</i>	c
<i>Corycaeus</i> sp., mutilated.....	1	<i>Paracalanus parvus</i>	c		

This nocturnal surface tow yielded only 5 species and is unworthy of comment except that every specimen was badly

parasitized by a fungus. The length of the tow was 0.1 mile and the volume 32 cm³.

STATION 116

July 1, 1929; 38° 41' N, 147° 41' E; bottom depth, 5545 m; 34 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	16.0	10.6	6.7	Density (σ_{tP})	24.9	26.1	27.0
Salinity, o/oo	34.0	33.7	33.8	Hydrogen-ion conc. (pH)	8.17	8.11	7.89
Volume of tow, cm ³	64	80	64	Length of tow, miles	0.6	0.5	0.6

<i>Acartia negligens</i>	a	c	..	<i>Heterorhabdus papilliger</i>.....	..	..	1
<i>Acrocalanus gibber</i>.....	..	2	..	<i>Lucicutia flavicornis</i>.....	..	5	4
<i>gracilis</i>.....	..	f	..	<i>Megacalanus princeps</i>.....	..	..	1
<i>Calanus propinquus</i>.....	..	f	..	<i>Metridia lucens</i>.....	..	..	r
<i>Calocalanus plumulosus</i>.....	..	f	..	<i>Microcalanus pygmaeus</i>.....	..	f	..
<i>Candacia armata</i>.....	..	2	..	<i>Microsetella rosea</i>.....	..	f	..
<i>simplex</i>.....	..	..	3	<i>Neocalanus gracilis</i>.....	..	f	..
<i>Canthocalanus pauper</i>	2	..	..	<i>tenuicornis</i>.....	..	f	..
<i>Chiridius poppei</i> , juv.....	..	1 ♂	..	<i>Oithona setiger</i>.....	..	5	..
<i>Clausocalanus arcuicornis</i>.....	..	a	a	<i>similis</i>.....	..	c	f
<i>Clytemnestra rostrata</i>.....	..	1	..	<i>spirostris</i>.....	..	c	f
<i>Corycaeus crassiusculus</i>.....	..	f	..	<i>Oncaea mediterranea</i>.....	..	..	3
<i>Eucalanus attenuatus</i>.....	..	f	f	<i>minuta</i>.....	..	..	f
<i>elongatus</i>.....	..	4	c	<i>venusta</i>.....	..	f	f
<i>Euchaeta acuta</i>.....	..	..	2	<i>Paracalanus parvus</i>	a	c	c
<i>Gaidius tenuispinus</i>.....	..	..	1	<i>pygmaeus</i>	f	..	..
<i>Haloptilus angusticeps</i>.....	..	1 ♀	..	<i>Pseudocalanus minutus</i>.....	..	c	c

The surface temperature was low and fell more than 9° in the 100 meters; the salinity and hydrogen-ion concentration changed but little. Only 4 species were taken at the surface, 24 in the 50-meter tow, and 18 in the 100-meter tow. Twenty-three species (70 per cent) were each confined to a single tow and only 1 (*Paracalanus parvus*) was present in all three

tows. *Corycaeus*, reduced to a single species, and *Oithona* and *Oncaea* with 3 species each, did not appear in the surface tow. *Candacia simplex* was here confined to the 100-meter tow, though usually found nearer the surface. The 50-meter tow was slightly shorter than either of the others but had the largest volume.

STATION 117

July 3, 1929; 40° 20' N, 150° 58' E; bottom depth, 5296 m; 33 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	15.9	12.5	8.8	Density (σ_{tP})	25.2	26.1	26.9
Salinity, o/oo	34.3	34.2	34.0	Hydrogen-ion conc. (pH)	8.17	8.06	7.98
Volume of tow, cm ³	384	128	96	Length of tow, miles	0.9	0.8	0.9

<i>Acartia negligens</i>	f	..	f	<i>Heterorhabdus papilliger</i>.....	..	..	2
<i>Acrocalanus gracilis</i>.....	..	f	c	<i>Lucicutia clausii</i>.....	..	..	1
<i>Calanus minor</i>.....	..	f	..	<i>flavicornis</i>.....	..	1	..
<i>propinquus</i>.....	..	..	f	<i>Metridia lucens</i>.....	..	..	r
<i>Calocalanus pavo</i>.....	..	2	..	<i>Microsetella rosea</i>.....	..	..	f
<i>plumulosus</i>.....	..	..	2	<i>Neocalanus tenuicornis</i>.....	..	..	1
<i>Candacia varicans</i>.....	..	..	1	<i>Oithona similis</i>	f	c	f
<i>Canthocalanus pauper</i>.....	..	2	..	<i>spinirostris</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>.....	..	a	a	<i>Oncaea minuta</i>.....	..	f	f
<i>Corycaeus crassiusculus</i>.....	..	f	f	<i>venusta</i>.....	..	f	..
<i>pumilus</i>.....	..	r	..	<i>Paracalanus parvus</i>	f	c	a
<i>typicus</i>.....	..	..	3	<i>pygmaeus</i>.....	..	..	4
<i>Eucalanus attenuatus</i>.....	..	2	f	<i>Pseudocalanus minutus</i>.....	..	c	a
<i>elongatus</i>.....	..	..	2	<i>Sapphirina auronitens</i>.....	..	..	1
<i>subtenuis</i>.....	..	2	..	<i>stellata</i>	2	..	..
<i>Farranula gibbula</i>	r	..	..	<i>Scolecithricella porrecta</i>.....	..	f	..
<i>rostrata</i>	f	..	..		

The surface temperature was low and fell almost 50 per cent in the 100 meters; the salinity and hydrogen-ion concentration changed comparatively little. Six species were taken in the surface tow, 16 in the 50-meter tow, and 22 in

the 100-meter tow. Twenty-four species (75 per cent) were each present in a single tow and 2 in all three tows. *Corycaeus*, *Eucalanus*, and *Oncaea* appeared in the two deeper tows, *Farranula* only at the surface, and *Oithona* in all tows.

STATION 118

July 5, 1929; 42° 29' N, 155° 24' E; bottom depth, 5404 m; 24 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	10.1	8.1	6.1	Density (σ_{tP})	25.8	26.5	27.0
Salinity, o/oo	33.8	33.7	33.7	Hydrogen-ion conc. (pH)	8.21	8.21	7.94
Volume of tow, cm ³	96	192	140	Length of tow, miles	1.4	1.3	1.4

<i>Acrocalanus gracilis</i>.....	..	f	f	<i>Lucicutia flavicornis</i>.....	..	..	c
<i>Bathycalanus rigidus</i>.....	..	1	5	<i>Macrosetella gracilis</i>.....	..	..	3
<i>Calanus finmarchicus</i>	3	..	2	<i>Metridia longa</i>.....	..	..	3
<i>hyperboreus</i>.....	..	a	a	<i>lucens</i>.....	..	..	5
<i>Calocalanus pavo</i>.....	..	..	1	<i>Microsetella rosea</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>.....	..	f	..	<i>Oithona attenuata</i>.....	..	..	4
<i>Clytemnestra rostrata</i>.....	..	..	1	<i>setiger</i>.....	..	4	5
<i>Eucalanus attenuatus</i>.....	..	f	2	<i>similis</i>.....	..	f	c
<i>crassus</i>.....	..	1	..	<i>spinirostris</i>.....	..	2	f
<i>elongatus</i>.....	..	a	c	<i>Oncaea minuta</i>.....	..	f	f
<i>Euchirella brevis</i>.....	..	..	3	<i>Paracalanus parvus</i>.....	..	f	f
<i>Lucicutia clausii</i>.....	..	..	f	<i>Pseudocalanus minutus</i>.....	..	f	..

The surface temperature was 5° lower than at the preceding station and fell 4° in the 100 meters; the salinity remained practically the same, but the hydrogen-ion concentration diminished at the 100-meter level. *Calanus finmarchicus* was the only species found in the surface tow; 13 species were found in the 50-meter tow, and 21 in the 100-meter tow. Thirteen species (54 per cent) were each confined to a single depth and no species was found at all three

depths. The numbers of both species and individuals are so small as to make it evident that the bulk of these northern tows is made up of other constituents of the plankton. The two deeper tows contain the only record for *Bathycalanus rigidus*. *Corycaeus* and *Farranula* entirely disappear and do not reappear until at station 130, and *Oncaea* is reduced to a single species. *Oithona* yielded 4 species but none of them were in the surface tow.

STATION 119

July 7, 1929; 45° 24' N, 159° 36' E; bottom depth, 5198 m; 16 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	6.9	3.0	1.6	Density (σ_{tP})	25.8	26.6	27.0
Salinity, o/oo	32.9	33.0	33.2	Hydrogen-ion conc. (pH)	7.96	7.92	7.85
Volume of tow, cm ³	31	31	62	Length of tow, miles	1.3	1.3	1.4

<i>Acrocalanus gracilis</i>.....	..	..	r	<i>Microsetella rosea</i>.....	..	f	c
<i>Calanus cristatus</i>.....	..	..	f	<i>Neocalanus gracilis</i>.....	..	f	f
<i>hyperboreus</i>.....	..	c	c	<i>robustior</i>.....	..	f	1
<i>Clausocalanus arcuicornis</i>.....	..	..	f	<i>Oithona attenuata</i>.....	..	..	c
<i>Eucalanus elongatus</i>.....	..	f	f	<i>similis</i>	3	c	a
<i>subtenuis</i>.....	..	3	..	<i>Paracalanus parvus</i>.....	..	..	f
<i>Macrosetella gracilis</i>.....	..	..	f	<i>Pseudocalanus minutus</i>	a	f	f
<i>Metridia lucens</i>.....	..	..	r	<i>Scolecithricella porrecta</i>.....	..	2	..

The surface temperature was the lowest for the entire cruise and fell almost 80 per cent in the 100 meters; the salinity was also low and increased slightly, and the hydrogen-ion concentration diminished. Two species were found in the surface tow, 9 in the 50-meter tow, and 14 in the 100-meter tow. Nine species (56 per cent) were each confined to a single tow and 2 were present in all three tows. Although

the temperature at the 50-meter level was only 3° and at the 100-meter level 1°6 above the freezing point, all the species except 2 had retired to the lower levels. This indicates that even a temperature which is very close to freezing is not an effective deterrent to negative phototropism. Aversion to strong light is more powerful than to low temperature, and the downward migration occurs regardless of temperature.

STATION 120

July 9, 1929; 47° 02' N, 166° 20' E; bottom depth, 5874 m; 19 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	7.1	2.1	2.0	Density (σ_{tP})	25.8	26.5	27.0
Salinity, o/oo	32.9	33.0	33.2	Hydrogen-ion conc. (pH)	7.98	7.90	7.84
Volume of tow, cm ³	310	186	159	Length of tow, miles	1.2	1.4	1.6

<i>Acrocalanus gracilis</i>.....	..	..	f	<i>Metridia lucens</i>.....	..	..	5
<i>Calanus cristatus</i>.....	..	f	c	<i>Microsetella rosea</i>.....	..	f	f
<i>finmarchicus</i>	*	2	..	<i>Neocalanus gracilis</i>	*	f	r
<i>hyperboreus</i>.....	..	c	a	<i>Oithona similis</i>	a	a	c
<i>Clausocalanus arcuicornis</i>.....	..	..	c	<i>Oncaea minuta</i>	a	f	..
<i>Eucalanus attenuatus</i>.....	..	f	..	<i>Paracalanus parvus</i>	*	..	c
<i>elongatus</i>.....	..	a	c	<i>Pseudocalanus minutus</i>	2	c	c
<i>Gaidius tenuispinus</i>.....	..	3	..	<i>Scolecithricella minor</i>.....	..	2	..
<i>Macrosetella gracilis</i>.....	..	2	..	<i>porrecta</i>.....	..	..	c
<i>Metridia longa</i>.....	..	..	4				

*Development stages.

The surface temperature was only a trifle higher than at the preceding station, and fell 72 per cent to only 2° above freezing at the two deeper levels. Six species were found at the surface, 13 in the 50-meter tow, and 13 in the 100-meter tow. Nine species (47 per cent) were each confined to a

single level and 3 were found at all three levels. Again we find a wholesale migration from the surface to the two lower levels in spite of the decrease in temperature. It will be noted also that 3 of the species were represented at the surface by development stages only.

STATION 121

July 11, 1929; 46° 05' N, 171° 32' E; bottom depth, 5684 m; 18 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	7.4	3.5	2.0	Density (σ_{tP})	25.7	26.5	27.0
Salinity, o/oo	32.9	33.0	33.1	Hydrogen-ion conc. (pH)	7.98	7.92	7.86
Volume of tow, cm ³	288	368	192	Length of tow, miles	1.3	1.3	1.4

<i>Acrocalanus gracilis</i>.....	..	f	..	<i>Microsetella rosea</i>.....	..	f	f
<i>Calanus finmarchicus</i>.....	..	..	2	<i>Neocalanus gracilis</i>	*	..	2
<i>hyperboreus</i>.....	..	a	a	<i>robustior</i>.....	..	3	..
<i>Clausocalanus arcuicornis</i>.....	..	f	f	<i>Oithona similis</i>	a	a	a
<i>Eucalanus elongatus</i>.....	..	a	c	<i>Oncaea minuta</i>.....	..	..	4
<i>Euchaeta acuta</i>.....	..	..	5	<i>Paracalanus parvus</i>.....	..	..	f
<i>Gaidius tenuispinus</i>.....	..	..	2	<i>Pseudocalanus minutus</i>.....	..	f	f
<i>Metridia longa</i>.....	..	3	3	<i>Scolecithricella bradyi</i>.....	..	..	1
<i>lucens</i>.....	..	5	c	<i>porrecta</i>.....	..	f	a

*Development stages.

The surface temperature was still very low and fell 73 per cent in the 100 meters; the salinity was also low and increased a trifle, and the hydrogen-ion concentration diminished. Only 2 species were found at the surface, 1 of which was made up of development stages; 11 species were found in the 50-meter tow and 16 in the 100-meter tow. Eight

species (44 per cent) were each confined to a single tow and only 1 was present in all three tows. *Oithona* and *Oncaea* were each reduced to a single species; the former was abundant in all three tows, the latter appeared only in the 100-meter tow. Although the copepods were comparatively few, the volumes of the three tows were each quite large.

STATION 122

July 13, 1929; 46° 16' N, 174° 03' E; bottom depth, 6077 m; 21 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	8.2	3.6	2.4	Density (σ_{tP})	25.5	26.5	26.9
Salinity, o/oo	32.8	33.0	33.1	Hydrogen-ion conc. (pH)	7.98	7.94	7.90
Volume of tow, cm ³	160	256	256	Length of tow, miles	1.3	2.0	2.1

<i>Acrocalanus gracilis</i>.....	..	..	f	<i>Microsetella rosea</i>	f	..	c
<i>Calanus cristatus</i>.....	..	..	5	<i>Neocalanus gracilis</i>.....	..	..	4
<i>finmarchicus</i>	a	2	4	<i>robustior</i>.....	..	2	2
<i>hyperboreus</i>.....	..	a	a	<i>Oithona similis</i>	a	a	a
<i>Clausocalanus arcuicornis</i>.....	..	c	..	<i>Oncaea minuta</i>.....	..	2	f
<i>Eucalanus attenuatus</i>.....	..	f	f	<i>Paracalanus parvus</i>	f	..	f
<i>elongatus</i>.....	..	f	c	<i>pygmaeus</i>.....	..	..	f
<i>Euchaeta acuta</i>.....	..	..	4	<i>Pseudocalanus minutus</i>	f	..	c
<i>Gaidius tenuispinus</i>.....	..	..	3	<i>Scolecithricella bradyi</i>.....	..	f	..
<i>Metridia longa</i>.....	..	c	c	<i>porrecta</i>.....	..	..	c
<i>lucens</i>.....	..	c	c				

The surface temperature was a little higher but fell 70 per cent in the 100 meters; both the salinity and the hydrogen-ion concentration were low, the former increasing slightly with depth, the latter decreasing. Five species were found at the surface, 11 in the 50-meter tow, and 19 in the 100-

meter tow. Nine species (45 per cent) were each confined to a single tow and 2 were present in all three tows. *Oithona* and *Oncaea* were still represented by a single species each, the former abundant in all three tows. The surface tow was made up almost entirely of *Oithona* and *Calanus finmarchicus*.

STATION 123

July 15, 1929; 50° 27' N, 172° 51' W; bottom depth, 5464 m; 16 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	8.1	4.4	3.0	Density (σ_{tP})	25.5	26.3	27.1
Salinity, o/oo	32.7	32.8	33.3	Hydrogen-ion conc. (pH)	8.03	7.94	7.79
Volume of tow, cm ³	320	....	....	Length of tow, miles	0.8	1.0	1.0

<i>Acartia danae</i>	a	..	..	<i>Metridia lucens</i>.....	..	c	c
<i>negligens</i>	a	f	..	<i>Microsetella rosea</i>.....	..	..	f
<i>Acrocalanus gracilis</i>.....	..	..	2	<i>Neocalanus robustior</i>.....	..	4	2
<i>Calanus finmarchicus</i>	*	..	2	<i>Oithona similis</i>.....	..	a	a
<i>hyperboreus</i>	*	f	c	<i>Oncaea minuta</i>.....	..	2	f
<i>Clausocalanus arcuicornis</i>.....	..	..	f	<i>Paracalanus parvus</i>.....	..	f	..
<i>Eucalanus elongatus</i>.....	..	3	c	<i>Pseudocalanus minutus</i>	a	f	f
<i>Megacalanus princeps</i>.....	..	..	1	<i>Scolecithricella porrecta</i>.....	..	..	f

*Development stages.

The surface temperature was still low, and fell 5° in the 100 meters; the salinity increased slightly and the hydrogen-ion concentration diminished. Five species were found at the surface, 9 in the 50-meter tow, and 13 in the 100-meter

tow. Seven species (40 per cent) were each confined to a single tow and 2 were present in all tows. The 2 *Calanus* species were represented at the surface by development stages. No *Oithona*, *Oncaea*, or *Metridia* appeared at the surface.

STATION 124

July 17, 1929; 52° 19' N, 162° 02' W; bottom depth, 4780 m; 17 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	9.3	5.3	4.0	Density (σ_t)	25.2	26.1	27.2
Salinity, o/oo	32.6	32.7	33.6	Hydrogen-ion conc. (pH)	8.04	8.02	7.64
Volume of tow, cm ³	31	256	93	Length of tow, miles	1.2	1.4	1.5

<i>Acartia danae</i>	f	..	..	<i>Megacalanus longicornis</i>	1	..	..
<i>negligens</i>	f	..	2	<i>Metridia lucens</i>.....	..	a	a
<i>Acrocalanus gracilis</i>.....	..	2	r	<i>Neocalanus gracilis</i>.....	..	f	2
<i>Calanus cristatus</i>.....	..	f	f	<i>Oithona similis</i>	a	a	..
<i>finmarchicus</i>	4	4	..	<i>Oncaea minuta</i>.....	..	f	4
<i>hyperboreus</i>	f	c	c	<i>Paracalanus parvus</i>	f	f	f
<i>Clausocalanus arcuicornis</i>.....	..	..	f	<i>Pseudocalanus minutus</i>	c	..	f
<i>Eucalanus attenuatus</i>.....	..	a	f	<i>Scolecithricella porrecta</i>.....	..	..	2
<i>elongatus</i>	f	..	2				

The surface temperature was a little higher but dropped 5° in the 100 meters; the salinity was low and increased slightly with depth, and the hydrogen-ion concentration diminished. Nine species were taken at the surface, 10 in the 50-meter tow, and 13 in the 100-meter tow. Only 4 species (25 per cent) were each confined to a single tow, and 2 were present in all three tows. The surface tow contained

many development stages along with the adults, but the former were so young they could not be identified with any certainty. The 50-meter tow was composed largely of *Eucalanus*, *Metridia*, and *Oithona*; *Metridia* was also very abundant in the 100-meter tow, but did not appear at the surface, whereas *Oithona* was abundant at the surface and in the 50-meter tow. *Oncaea* was confined to the two deeper tows.

STATION 125

July 19, 1929; 51° 58' N, 150° 39' W; bottom depth, 4536 m; 10 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	10.5	5.5	4.2	Density (σ_t)	25.1	26.1	26.6
Salinity, o/oo	32.7	32.8	32.9	Hydrogen-ion conc. (pH)	8.03	7.98	7.89
Volume of tow, cm ³	31	64	93	Length of tow, miles	1.4	1.0	1.1

<i>Acrocalanus gracilis</i>.....	..	f	..	<i>Eucalanus elongatus</i>.....	..	c	a
<i>Calanus finmarchicus</i>	f	..	4	<i>Metridia lucens</i>.....	..	2	f
<i>hyperboreus</i>	*	c	a	<i>Neocalanus gracilis</i>.....	..	f	..
<i>Clausocalanus arcuicornis</i>.....	..	..	2	<i>Oithona similis</i>	a	a	a
<i>Eucalanus attenuatus</i>.....	..	f	..	<i>Pseudocalanus minutus</i>.....	..	f	f

*Development stages.

The surface temperature was a degree higher than at the preceding station, but fell 6° in the 100 meters. The low salinity increased a trifle, and the hydrogen-ion concentration diminished. Three species were taken at the surface, 1 of them represented entirely by development stages; 8 species

were taken in the 50-meter tow, and 7 in the 100-meter tow. Only 4 species (40 per cent) were each confined to a single tow, and 2 were present in all three tows. *Oithona* was abundant in all three tows, but on the other hand, *Oncaea* does not appear in any of them.

STATION 126

July 21, 1929; 48° 05' N, 142° 56' W; bottom depth, 4382 m; 13 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	11.2	7.7	6.4	Density (σ_{tP})	24.9	25.7	26.1
Salinity, o/oo	32.6	32.6	32.7	Hydrogen-ion conc. (pH)	8.09	8.04	8.01
Volume of tow, cm ³	62	....	....	Length of tow, miles	1.9	....	....

<i>Aetideus armatus</i>.....	..	..	1	<i>Microsetella rosea</i>.....	..	..	f
<i>Calanus cristatus</i>.....	..	1	..	<i>Oithona similis</i>.....	..	..	c
<i>finmarchicus</i>	f	..	f	<i>spinirostris</i>.....	..	..	2
<i>hyperboreus</i>	c	3	c	<i>Oncaea minuta</i>.....	..	..	f
<i>Eucalanus elongatus</i>.....	..	..	3	<i>Pseudocalanus minutus</i>	1	..	4
<i>Lucicutia flavicornis</i>.....	..	..	1	<i>Scolecithricella abyssalis</i>.....	..	..	f
<i>Macrosetella gracilis</i>.....	..	..	2				

The surface temperature was again 1° higher than at the preceding station, and fell nearly 5° in the 100 meters; the salinity remained practically the same, and the hydrogen-ion concentration diminished a little. Three species were taken

at the surface, 2 in the 50-meter tow, and 12 in the 100-meter tow. Ten species (77 per cent) were each confined to a single tow and only 1 appeared in all three tows. *Oncaea* appeared again, but with *Oithona* was found only at 100 meters.

STATION 127

July 23, 1929; 44° 16' N, 137° 37' W; bottom depth, 4026 m; 14 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	13.3	10.5	8.2	Density (σ_{tP})	24.5	25.3	25.9
Salinity, o/oo	32.6	32.7	32.7	Hydrogen-ion conc. (pH)	8.12	8.09	8.00
Volume of tow, cm ³	64	128	128	Length of tow, miles	1.9	2.1	2.2

<i>Acrocalanus gracilis</i>	c	..	..	<i>Neocalanus gracilis</i>.....	..	f	a
<i>Calanus cristatus</i>.....	..	f	..	<i>tenuicornis</i>.....	..	..	a
<i>finmarchicus</i>	a	a	c	<i>Oithona similis</i>	f	f	a
<i>hyperboreus</i>.....	..	a	c	<i>spinirostris</i>.....	..	..	c
<i>Clausocalanus arcuicornis</i>	c	..	..	<i>Oithonina nana</i>.....	..	..	f
<i>Eucalanus attenuatus</i>	f	f	c	<i>Paracalanus parvus</i>	4	..	..
<i>crassus</i>.....	..	..	1	<i>Pseudocalanus minutus</i>.....	..	..	r

The surface temperature was somewhat higher and fell about 5° in the 100 meters; the salinity was low and increased a trifle, and the hydrogen-ion concentration diminished. Six species were found at the surface, 6 in the 50-meter tow, and 10 in the 100-meter tow. Nine species (64 per cent) were

each confined to a single tow and 3 were present in all three tows. The volumes of the two deeper tows were the same and each was twice that of the surface tow. There were many development stages of *Calanus finmarchicus* with the adults at the surface.

STATION 128

July 25, 1929; 40° 37' N, 132° 23' W; bottom depth, 3806 m; 7 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	16.4	11.7	Density (σ_{tP})	24.1	25.4
Salinity, o/oo	32.9	33.0	Hydrogen-ion concentration (pH)	8.12	8.11
Volume of tow, cm ³	48	96	Length of tow, miles	1.0	1.0

Acrocalanus gracilis.....	c	f	Oithona similis.....	f	a
Clausocalanus arcuicornis.....	a	..	Paracalanus parvus.....	c	2
Clytemnestra rostrata.....	..	2	Pseudocalanus minutus.....	a	..
Neocalanus gracilis.....	..	f			

The temperature was moderate at the surface and fell nearly 5° at the 50-meter level; the salinity and hydrogen-ion concentration scarcely changed. Five species were captured at the surface and 5 in the 50-meter tow. Four species (57 per cent) were each confined to one tow and 3 appeared in

both tows. The length of the two tows was exactly the same, but the volume of the 50-meter tow was twice that of the surface tow. *Clausocalanus* and *Pseudocalanus* made up the bulk of the surface tow and *Oithona* that of the 50-meter tow.

STATION 130

September 4, 1929; 37° 05' N, 123° 43' W; bottom depth, 3188 m; 45 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	16.2	11.7	8.8	Density (σ_{tP})	24.4	25.6	26.6
Salinity, o/oo	33.4	33.4	33.7	Hydrogen-ion conc. (pH)	8.34	8.26	8.06
Volume of tow, cm ³	224	192	190	Length of tow, miles	0.7	0.9	0.9

Acartia danae.....	..	..	1	Lucicutia flavicornis.....	..	..	f
Acrocalanus gracilis.....	..	..	f	longicornis.....	..	..	1
monachus.....	..	..	f	Macrosetella gracilis.....	..	c	f
Calanus finmarchicus.....	a	..	f	Metridia brevicauda.....	..	..	f
hyperboreus.....	..	2	..	lucens.....	..	..	c
propinquus.....	..	..	1	Microcalanus pygmaeus.....	..	..	1
Clausocalanus arcuicornis.....	..	f	..	Microsetella norvegica.....	..	f	2
Corycaeus anglicus.....	..	r	..	rosca.....	..	r	..
catus.....	..	..	r	Oithona similis.....	f	c	c
crassiusculus.....	c	f	f	spirostris.....	..	..	f
flaccus.....	..	3	..	Oithonina nana.....	..	..	f
limbatus.....	r	r	..	Oncaea confiera.....	..	..	f
pumilus.....	r	..	..	media.....	..	..	c
speciosus.....	1	..	..	minuta.....	..	..	1
typicus.....	..	..	f	venusta.....	..	..	f
Eucalanus attenuatus.....	..	..	2	Paracalanus parvus.....	a	f	c
elongatus.....	..	c	f	pygmaeus.....	..	..	2
Euchaeta marina.....	..	..	1	Pseudocalanus minutus.....	a	a	c
Farranula carinata.....	f	..	..	Sapphirina angusta.....	1	..	..
concinna.....	c	..	..	Spinocalanus abyssalis.....	..	..	2
gibbula.....	..	f	..	caudatus.....	..	..	1
rostrata.....	f	f	f	Undeuchaeta sp., juv.....	..	..	1♂
Gaidius tenuispinus.....	..	..	4				

The temperature was moderate at the surface and fell almost 50 per cent in the 100 meters; the salinity increased a little and the hydrogen-ion concentration diminished. Twelve species were taken at the surface, 15 in the 50-meter tow, and 33 in the 100-meter tow. Thirty-five species (80 per cent) were each confined to a single tow and 5 were present in all three tows. The two deeper tows were 30 per

cent longer than the surface tow but the volume of the latter was somewhat larger. *Corycaeus*, *Farranula*, and *Oncaea* reappear in goodly numbers, the two former well distributed in all three tows, the latter strictly confined to the 100-meter tow. The *Undeuchaeta* which was recorded in the deepest tow was a juvenile male with its fifth legs only partially developed.

STATION 132

September 8, 1929; 31° 38' N, 128° 48' W; bottom depth, 4251 m; 82 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	21.0	17.5	14.3	Density (σ_{tP})	23.6	24.7	25.3
Salinity, ‰	33.9	33.8	33.4	Hydrogen-ion conc. (pH)	8.34	8.33	8.30
Volume of tow, cm ³	32	48	48	Length of tow, miles	1.0	1.0	1.3

<i>Acartia danae</i>	c	3	c	<i>Lubbockia aculeata</i>.....	..	f	a
<i>negligens</i>.....	..	r	..	<i>squillimana</i>.....	..	f	3
<i>Acrocalanus gibber</i>.....	..	2	..	<i>Lucicutia clausii</i>.....	..	c	2
<i>gracilis</i>.....	..	4	f	<i>flavicornis</i>.....	..	a	c
<i>Calanus minor</i>.....	..	1	..	<i>Macrosetella gracilis</i>	c	2	r
<i>Calocalanus pavo</i>.....	..	c	c	<i>Mecynocera clausi</i>.....	..	c	a
<i>plumulosus</i>.....	..	2	..	<i>Microcalanus pusillus</i>.....	..	r	r
<i>styliremis</i>.....	..	..	2	<i>pygmaeus</i>.....	..	2	r
<i>Candacia bipinnata</i>.....	..	..	1	<i>Microsetella norvegica</i>	c	f	f
<i>norvegica</i>.....	..	1	..	<i>rosca</i>.....	..	f	r
<i>simplex</i>.....	..	r	5	<i>Neocalanus gracilis</i>.....	..	r	f
<i>truncata</i>.....	..	..	3	<i>robustior</i>.....	..	..	2
<i>Clausocalanus arcuicornis</i>	c	r	c	<i>tenuicornis</i>.....	..	..	2
<i>furcatus</i>.....	..	c	a	<i>Oithona brevicornis</i>.....	..	3	r
<i>Clytemnestra rostrata</i>.....	..	1	4	<i>similis</i>.....	..	c	f
<i>scutellata</i>.....	..	f	f	<i>spinostris</i>.....	..	f	a
<i>Corycaeus catus</i>.....	..	2	2	<i>Oithonina nana</i>.....	..	r	4
<i>clausi</i>.....	..	1	..	<i>Oncaea conifera</i>.....	..	..	2
<i>crassiusculus</i>	f	f	..	<i>curta</i>.....	..	c	f
<i>flaccus</i>.....	..	f	5	<i>media</i>.....	..	c	..
<i>lautus</i>.....	..	c	c	<i>mediterranea</i>.....	..	r	r
<i>limbatus</i>.....	..	r	c	<i>minuta</i>.....	..	a	a
<i>longistylis</i>.....	..	f	c	<i>notopa</i>.....	..	r	..
<i>pumilus</i>.....	..	..	3	<i>similis</i>.....	..	c	f
<i>robustus</i>.....	..	f	r	<i>subtilis</i>.....	..	f	..
<i>speciosus</i>	c	f	c	<i>tenella</i>.....	..	r	r
<i>typicus</i>.....	..	r	f	<i>venusta</i>.....	..	c	a
<i>Eucalanus attenuatus</i>.....	..	1	..	<i>Pachos punctatum</i>.....	..	1	..
<i>elongatus</i>.....	..	2	r	<i>Paracalanus aculeatus</i>.....	..	4	..
<i>subtenuis</i>.....	..	2	..	<i>parvus</i>.....	..	c	a
<i>Farranula carinata</i>	c	2	f	<i>pygmaeus</i>	2	c	c
<i>concinna</i>	2	..	..	<i>Phaenna spinifera</i>.....	..	..	5
<i>rostrata</i>.....	..	..	f	<i>Pleuromamma gracilis</i>.....	..	r	..
<i>Haloptilus acutifrons</i>.....	..	1	1	<i>Pontellina plumata</i>.....	..	1	..
<i>longicornis</i>.....	..	r	a	<i>Pseudocalanus minutus</i>	f	c	c
<i>ornatus</i>.....	..	2	..	<i>Sapphirina angusta</i>.....	..	..	1
<i>plumosus</i>.....	..	..	3	<i>auronitens</i>	1	..	1
<i>spiniceps</i>.....	..	3	2	<i>metallina</i>.....	..	..	1
<i>Heterorhabdus papilliger</i>.....	..	2	2	<i>Spinocalanus caudatus</i>	r	..	..
<i>spinifrons</i>.....	..	..	1	<i>Undinula darwinii</i>.....	..	1	f
<i>Heterostylices longicornis</i>.....	..	..	3	<i>Vetтория granulosa</i>.....	..	..	2

The temperature was moderate at the surface and fell nearly 7° in the 100 meters; the salinity and hydrogen-ion concentration both diminished a little. Thirteen species were taken at the surface, 63 in the 50-meter tow, and 63 in the 100-meter tow. Thirty-two species (40 per cent) were each confined to a single tow and 7 were present in all three tows.

Corycaeus was represented by 11 species and *Oncaea* by 10 species, and 19 of these 21 species appeared only in the two deeper tows. *Farranula*, however, was distributed in all three tows. There were 5 species of *Haloptilus*, 2 of *Heterorhabdus*, and 3 of *Oithona*; all 10 species were confined to the two deeper tows.

STATION 133

September 10, 1929; 29° 21' N, 132° 30' W; bottom depth, 4426 m; 71 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	22.6	20.7	18.4	Density (σ_{tP})	23.8	24.5	25.4
Salinity, o/oo	34.7	34.7	34.7	Hydrogen-ion conc. (pH)	8.47	8.37	8.31
Volume of tow, cm ³	32	32	32	Length of tow, miles	1.1	1.1	1.2

<i>Acartia danae</i>	1	c	f	<i>Lubbockia squillimana</i>.....	..	..	5
<i>Acrocalanus gibber</i>	f	..	..	<i>Lucicutia clausii</i>.....	..	..	r
<i>gracilis</i>.....	..	f	c	<i>flavicornis</i>.....	..	f	..
<i>Calanus minor</i>.....	..	..	r	<i>Macrosetella gracilis</i>.....	..	f	..
<i>Calocalanus pavo</i>.....	..	c	..	<i>Mecynocera clausi</i>	r	a	a
<i>Candacia bispinosa</i>.....	..	..	3	<i>Megacalanus longicornis</i>.....	..	r	..
<i>simplex</i>.....	..	r	f	<i>Microcalanus pusillus</i>.....	..	f	f
<i>Centropages calaninus</i>.....	..	1	..	<i>Microsetella norvegica</i>.....	..	r	..
<i>hamatus</i>.....	..	..	2	<i>rosea</i>.....	..	f	f
<i>Clausocalanus arcuicornis</i>	f	..	f	<i>Neocalanus gracilis</i>.....	..	f	f
<i>furcatus</i>.....	..	a	..	<i>robustior</i>.....	..	4	r
<i>Clytemnestra rostrata</i>.....	..	..	3	<i>tenuicornis</i>.....	..	..	3
<i>scutellata</i>.....	..	f	..	<i>Oithona attenuata</i>.....	..	r	..
<i>Corycaeus crassiusculus</i>.....	..	r	..	<i>brevicornis</i>.....	..	3	..
<i>flaccus</i>.....	..	5	..	<i>similis</i>	1	c	c
<i>lautus</i>.....	..	f	..	<i>spinirostris</i>.....	..	c	f
<i>limbatus</i>.....	..	c	..	<i>Oithonina nana</i>.....	..	r	..
<i>longistylis</i>	c	c	r	<i>Oncaea curta</i>.....	..	f	..
<i>pumilus</i>.....	..	3	..	<i>media</i>.....	..	c	..
<i>robustus</i>.....	..	4	..	<i>mediterranea</i>.....	..	r	..
<i>speciosus</i>	f	f	f	<i>minuta</i>.....	..	a	a
<i>typicus</i>.....	..	f	..	<i>venusta</i>.....	..	r	a
<i>Eucalanus crassus</i>.....	..	..	2	<i>Paracalanus aculeatus</i>.....	..	5	..
<i>elongatus</i>.....	..	f	f	<i>parvus</i>.....	..	a	a
<i>Euchaeta marina</i>.....	..	..	r	<i>pygmaeus</i>.....	..	..	r
<i>Euchirella brevis</i>.....	..	1	..	<i>Pontella atlantica</i>	1	..	..
<i>curticauda</i>.....	..	2	..	<i>lobiancoi</i>	3	..	..
<i>Farranula carinata</i>.....	..	f	f	<i>Pontellina plumata</i>.....	..	2	..
<i>curta</i>	r	r	..	<i>Pseudocalanus minutus</i>	r	f	f
<i>gibbula</i>	c	..	..	<i>Sapphirina auronitens</i>.....	..	1	..
<i>rostrata</i>	f	c	..	<i>metallina</i>.....	..	..	2
<i>Haloptilus longicornis</i>.....	..	c	c	<i>opalina</i>.....	..	1	..
<i>spiniceps</i>.....	..	2	..	<i>Scolecithrix danae</i>.....	..	3	..
<i>Heterorhabdus spinifrons</i>.....	..	2	..	<i>Undeuchaeta major</i>.....	..	..	2
<i>Labidocera detruncata</i>	c	..	..	<i>Undinula darwinii</i>.....	..	f	a
<i>Lubbockia aculeata</i>.....	..	c	..				

The temperature dropped only 4° in the 100 meters; the salinity and hydrogen-ion concentration remained almost constant. Fourteen species were taken at the surface, 53 in the 50-meter tow, and 33 in the 100-meter tow. Forty-seven species (66 per cent) were each confined to a single tow and 6 were found in all three tows. *Corycaeus*, *Farranula*, *Oithona*,

and *Oncaea* were for the most part in the 50-meter tow, and *Oncaea* did not appear at all in the surface tow. The 100-meter tow contains one of the two records for *Centropages hamatus* in the Pacific; since in the other record, station 55, it was found at the surface, very little can be told about its reaction to light.

STATION 134

September 12, 1929; 27° 45' N, 135° 22' W; bottom depth, 4528 m; 46 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	22.8	19.7	18.1	Density (σ_{tP})	23.7	24.7	25.4
Salinity, o/oo	34.7	34.5	34.6	Hydrogen-ion conc. (pH)	8.34	8.34	8.34
Volume of tow, cm ³	32	48	32	Length of tow, miles	0.6	0.5	0.6

<i>Acartia danae</i>.....	..	f	..	<i>Labidocera detruncata</i>	c	..	..
<i>Acrocalanus gibber</i>	f	..	..	<i>Lucicutia clausii</i>.....	..	..	c
<i>gracilis</i>	f	f	..	<i>Macrosetella gracilis</i>	1	..	..
<i>Calanus minor</i>.....	..	c	f	<i>Mecynocera clausi</i>.....	..	a	f
<i>Calocalanus pavo</i>.....	..	..	r	<i>Megacalanus longicornis</i>.....	..	a	..
<i>styliremis</i>.....	..	..	1	<i>Microcalanus pusillus</i>.....	..	..	2
<i>Candacia simplex</i>.....	..	..	f	<i>Miracia efferata</i>.....	..	..	3
<i>Canthocalanus pauper</i>.....	..	c	f	<i>Neocalanus gracilis</i>.....	..	c	r
<i>Centropages violaceus</i>.....	..	2	..	<i>robustior</i>.....	..	a	c
<i>Clausocalanus arcuicornis</i>	r	..	f	<i>tenuicornis</i>.....	..	..	f
<i>Corycaeus crassiusculus</i>.....	..	f	..	<i>Oithona attenuata</i>	1	..	..
<i>lautus</i>	f	..	..	<i>similis</i>.....	..	c	c
<i>longistylis</i>	f	..	2	<i>spirostris</i>.....	..	f	2
<i>pumilus</i>.....	..	..	r	<i>Oithonina nana</i>.....	..	..	f
<i>speciosus</i>	2	c	c	<i>Oncaea media</i>	r	..	..
<i>Eucalanus elongatus</i>.....	..	1	1	<i>minuta</i>.....	..	c	c
<i>Euchaeta marina</i>.....	..	f	..	<i>tenella</i>.....	..	r	..
<i>Euchirella brevis</i>.....	..	1	..	<i>venusta</i>.....	..	..	f
<i>Farranula carinata</i>.....	..	c	a	<i>Paracalanus aculeatus</i>	3	..	..
<i>concinna</i>	1	..	..	<i>parvus</i>.....	..	c	a
<i>gibbula</i>	c	..	..	<i>pygmaeus</i>.....	..	..	2
<i>rostrata</i>	c	..	..	<i>Sapphirina metallina</i>.....	..	..	3
<i>Haloptilus longicornis</i>.....	..	f	2	<i>Undinula darwinii</i>.....	..	a	a

The temperature was high at the surface and dropped 4.7; the salinity and hydrogen-ion concentration remained practically unchanged. Fourteen species were taken at the surface, 22 in the 50-meter tow, and 28 in the 100-meter tow. Twenty-nine species (63 per cent) were each confined to a single tow, and 1 species alone was present in all three tows.

Farranula, except *carinata*, appeared only at the surface, but *Corycaeus*, *Oithona*, and *Oncaea* were distributed in all the tows. The 50-meter tow was 10 per cent shorter than either of the other two, but its volume was 50 per cent larger. *Candacia simplex*, which is usually nearer the surface, was here found only in the 100-meter tow.

BETWEEN STATIONS 134 AND 135

September 13, 1929; 26° 44' N, 138° 27' W; 29 species

<i>Acartia danae</i>	c	<i>Corycaeus speciosus</i>	f	<i>Neocalanus tenuicornis</i>	2
<i>Acrocalanus gracilis</i>	f	<i>Euchaeta marina</i>	f	<i>Oithonina nana</i>	r
<i>Calanus minor</i>	f	<i>Farranula carinata</i>	a	<i>Oncaea media</i>	f
<i>propinquus</i>	1	<i>gibbula</i>	r	<i>minuta</i>	f
<i>Calocalanus pavo</i>	f	<i>rostrata</i>	r	<i>venusta</i>	c
<i>Centropages furcatus</i>	2	<i>Labidocera acutifrons</i>	c	<i>Paracalanus parvus</i>	c
<i>Clausocalanus arcuicornis</i>	2	<i>Macrosetella gracilis</i>	2	<i>Pontellina plumata</i>	2
<i>Clytemnestra rostrata</i>	f	<i>Mecynocera clausi</i>	r	<i>Sapphirina auronitens</i>	3
<i>scutellata</i>	f	<i>Microsetella rosea</i>	f	<i>Undinula darwinii</i>	a
<i>Corycaeus longistylis</i>	2	<i>Neocalanus robustior</i>	c		

Volume of tow, 32cm³; length, 0.1 mile; surface only. This nocturnal tow between stations yielded 29 species. Two species were obtained that were not found at either station 134 or 135, and 50 species obtained at one or both of those stations do not appear here. Many species also which were

found at the regular stations in the two deeper tows alone are present here at the surface. These marked differences again furnish good evidence of nocturnal migration and suggest that this tow was taken after midnight, when the downward movement had already been in progress for some time.

STATION 135

September 14, 1929; 26° 39' N, 139° 07' W; bottom depth, 4695 m; 65 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	23.7	21.5	18.7	Density (σ_{tP})	23.8	24.6	25.4
Salinity, o/oo	35.1	35.0	34.8	Hydrogen-ion conc. (pH)	8.37	8.37	8.34
Volume of tow, cm ³	48	32	32	Length of tow, miles	0.4	0.5	0.5

<i>Acartia danae</i>.....	..	f	f	<i>Lubbockia squillimana</i>.....	..	2	..
<i>Acrocalanus gracilis</i>	f	..	f	<i>Lucicutia clausii</i>.....	..	c	..
<i>longicornis</i>	2	..	..	<i>flavicornis</i>.....	..	c	c
<i>Calocalanus pavo</i>	2	f	f	<i>Macrosetella gracilis</i>	2	..	..
<i>plumulosus</i>.....	..	2	2	<i>oculata</i>.....	..	1	..
<i>styliremis</i>.....	..	f	..	<i>Mecynocera clausi</i>	3	f	c
<i>Candacia aethiopica</i>	c	..	..	<i>Microcalanus pusillus</i>.....	..	1	..
<i>bispinosa</i>	f	c	1	<i>pygmaeus</i>.....	..	f	1
<i>norvegica</i>	c	..	2	<i>Microsetella rosea</i>.....	..	..	c
<i>simplex</i>	c	f	f	<i>Miracia efferata</i>	2	..	..
<i>Centropages furcatus</i>.....	..	..	1	<i>Neocalanus gracilis</i>.....	..	c	c
<i>violaceus</i>.....	..	..	2	<i>tenuicornis</i>.....	..	..	a
<i>Clausocalanus arcuicornis</i>	c	c	a	<i>Oithona similis</i>.....	..	c	a
<i>furcatus</i>	2	f	1	<i>spirostris</i>.....	..	f	f
<i>Clytemnestra scutellata</i>	2	..	2	<i>Oithonina nana</i>.....	..	f	f
<i>Copilia denticulata</i>.....	..	..	2	<i>Oncaea media</i>.....	..	..	f
<i>Corycaeus agilis</i>	2	..	..	<i>minuta</i>	c	a	c
<i>crassiusculus</i>.....	..	f	f	<i>similis</i>.....	..	f	..
<i>longistylis</i>	3	f	..	<i>venusta</i>	f	c	c
<i>pumilus</i>.....	..	r	..	<i>Pachos punctatum</i>.....	..	..	1
<i>speciosus</i>	c	c	c	<i>Paracalanus parvus</i>	f	c	c
<i>typicus</i>	r	..	..	<i>pygmaeus</i>.....	..	f	f
<i>Eucalanus elongatus</i>.....	..	..	1	<i>Phaenna spinifera</i>	1	..	..
<i>mucronatus</i>.....	..	..	1	<i>Pleuromanma gracilis</i>.....	..	1	1
<i>Euchaeta marina</i>.....	..	..	c	<i>Pontella tenuiremis</i>	f	..	..
<i>Farranula carinata</i>	a	a	c	<i>Pontellina plumata</i>.....	..	1	..
<i>gibbula</i>	c	..	..	<i>Pseudocalanus minutus</i>.....	..	f	f
<i>gracilis</i>	r	..	..	<i>Sapphirina auronitens</i>	f	f	..
<i>rostrata</i>.....	..	..	f	<i>metallina</i>.....	..	..	c
<i>Haloptilus acutifrons</i>.....	..	1	..	<i>Scolecithrix danae</i>.....	..	..	1
<i>longicornis</i>.....	..	c	f	<i>Undinula darwini</i>.....	..	..	3
<i>spiniceps</i>.....	..	2	..	<i>vulgaris</i>.....	..	..	c
<i>Labidocera acutifrons</i>	a	..	..		

The temperature was high at the surface and fell 5° in the 100 meters; the salinity and hydrogen-ion concentration changed but little. Twenty-seven species were taken at the surface, 36 in the 50-meter tow, and 42 in the 100-meter tow, a more uniform vertical distribution than usual. Thirty-

six species (55 per cent) were each confined to a single tow and 11 were present in all three tows. *Candacia*, *Corycaeus*, *Farranula*, and *Oncaea* were here distributed in all three tows, but neither of the 2 species of *Oithona* appeared at the surface.

STATION 136

September 16, 1929; 26° 13' N, 142° 02' W; bottom depth, 4713 m; 76 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	24.5	21.4	18.6	Density (σ_{tP})	23.7	24.7	25.5
Salinity, ‰	35.3	35.1	35.0	Hydrogen-ion conc. (pH)	8.37	8.39	8.39
Volume of tow, cm ³	32	32	32	Length of tow, miles	1.2	1.2	1.2
<i>Acartia clausii</i>.....	..	..	1	<i>Haloptilus longicornis</i>.....	..	c	a
<i>danae</i>.....	..	c	r	<i>plumosus</i>.....	..	..	1
<i>Acrocalanus gibber</i>	f	..	..	<i>spiniceps</i>.....	..	3	..
<i>gracilis</i>	f	3	f	<i>Heterorhabdus papilliger</i>.....	..	..	f
<i>longicornis</i>	f	..	..	<i>Labidocera acutifrons</i>	1	..	..
<i>Aetideus armatus</i>.....	..	..	2	<i>detruncata</i>	a	..	..
<i>Calanus minor</i>.....	..	f	c	<i>Lubbockia aculeata</i>.....	..	2	..
<i>propinquus</i>.....	..	..	1	<i>squillimana</i>.....	..	2	c
<i>Calocalanus pavo</i>	1	r	f	<i>Lucicutia clausii</i>.....	..	..	c
<i>plumulosus</i>.....	..	..	1	<i>flavicornis</i>.....	..	..	a
<i>Candacia aethiopica</i>.....	..	1	..	<i>Macrosetella gracilis</i>.....	..	2	1
<i>bispinosa</i>.....	..	..	c	<i>Mecynocera clausi</i>.....	..	a	c
<i>longimana</i>.....	..	..	3	<i>Megacalanus longicornis</i>.....	..	f	f
<i>norvegica</i>.....	..	..	c	<i>Microcalanus pusillus</i>.....	..	3	..
<i>simplex</i>.....	..	f	f	<i>pygmaeus</i>.....	..	f	..
<i>Canthocalanus pauper</i>	1	..	..	<i>Microsetella rosea</i>	f	f	f
<i>Centropages violaceus</i>.....	..	2	2	<i>Miracia efferata</i>.....	..	1	2
<i>Clausocalanus arcuicornis</i>	a	c	a	<i>Neocalanus gracilis</i>.....	..	a	a
<i>furcatus</i>	f	..	..	<i>robustior</i>.....	..	c	c
<i>Clytemnestra rostrata</i>.....	..	..	f	<i>tenuiremis</i>.....	..	c	f
<i>scutellata</i>.....	..	f	f	<i>Oithona similis</i>.....	..	a	a
<i>Copilia denticulata</i>.....	..	..	2	<i>spinirostris</i>.....	..	f	..
<i>quadrata</i>.....	..	1	1	<i>Oithonina nana</i>.....	..	f	c
<i>Corycaeus agilis</i>	3	..	..	<i>Oncaea minuta</i>	f	..	a
<i>catulus</i>.....	..	3	..	<i>venusta</i>	f	..	a
<i>crassiusculus</i>.....	..	..	f	<i>Paracalanus parvus</i>	c	..	c
<i>lautus</i>.....	..	2	..	<i>pygmaeus</i>.....	..	f	f
<i>longistylis</i>	f	f	f	<i>Phaenna spinifera</i>	1	..	..
<i>pumilus</i>.....	..	..	f	<i>Pleuromamma gracilis</i>.....	..	..	f
<i>speciosus</i>	c	..	a	<i>robusta</i>.....	..	..	f
<i>typicus</i>	r	..	..	<i>Pontella tenuiremis</i>	1	..	..
<i>Eucalanus attenuatus</i>.....	..	2	f	<i>Pontellina plumata</i>.....	..	..	r
<i>elongatus</i>.....	..	2	..	<i>Pseudocalanus minutus</i>	c	..	..
<i>Euchaeta acuta</i>.....	..	3	..	<i>Sapphirina metallina</i>.....	..	..	r
<i>marina</i>.....	..	a	a	<i>nigromaculata</i>.....	..	1	..
<i>Farranula carinata</i>	a	..	a	<i>opalina</i>.....	..	2	..
<i>gibbula</i>	f	..	..	<i>Scolecithrix danae</i>.....	..	1	f
<i>rostrata</i>	1	..	..	<i>Undinula darwinii</i>.....	..	c	a

The temperature was high at the surface and fell 6° in the 100 meters; the salinity decreased and the hydrogen-ion concentration increased with the depth, both very slightly. Twenty-three species were taken at the surface, 39 in the 50-meter tow, and 51 in the 100-meter tow. Forty-five species

(60 per cent) were each confined to a single tow and 5 were present in all three tows. *Corycaeus* was distributed in all three tows, *Farranula* and *Oncaea* did not appear in the 50-meter tow, and *Oithona* and *Candacia* were not found at the surface. Lengths and volumes of all the tows were the same.

STATION 137

September 18, 1929; 24° 02' N, 145° 33' W; bottom depth, 5208 m; 65 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	25.4	24.4	21.5	Density (σ_{t})	23.1	23.8	24.8
Salinity, o/oo	34.9	35.1	35.0	Hydrogen-ion conc. (pH)	8.39	8.34	8.30
Volume of tow, cm ³	32	96	32	Length of tow, miles	2.2	1.6	1.8

<i>Acartia danae</i>	r	r	c	<i>Haloptilus longicornis</i>.....	..	f	1
<i>Acrocalanus gibber</i>	a	..	..	<i>plumosus</i>.....	..	..	2
<i>gracilis</i>	a	2	f	<i>spiniceps</i>.....	..	f	2
<i>Aetideus armatus</i>.....	..	..	f	<i>Labidocera nerii</i>	c	..	..
<i>Calanus minor</i>.....	..	..	f	<i>Lucicutia clausii</i>.....	..	..	c
<i>propinquus</i>.....	..	..	2	<i>flavicornis</i>.....	..	..	c
<i>Calocalanus pavo</i>	2	c	r	<i>Mecynocera clausi</i>.....	..	a	c
<i>Candacia bispinosa</i>.....	..	..	f	<i>Megacalanus longicornis</i>.....	..	a	f
<i>simplex</i>.....	..	3	f	<i>Microcalanus pygmaeus</i>.....	..	..	f
<i>Canthocalanus pauper</i>.....	..	2	r	<i>Microsetella rosea</i>	f	c	f
<i>Centropages furcatus</i>.....	..	..	2	<i>Miracia efferata</i>	1	..	..
<i>Clausocalanus arcuicornis</i>	c	a	c	<i>Neocalanus gracilis</i>.....	..	a	a
<i>furcatus</i>	2	..	..	<i>robustior</i>.....	..	c	f
<i>Clytemnestra rostrata</i>.....	..	..	f	<i>tenuicornis</i>.....	..	a	a
<i>scutellata</i>	1	3	f	<i>Oithona similis</i>	c	a	a
<i>Copilia denticulata</i>.....	..	1	..	<i>spirostris</i>.....	..	a	c
<i>quadrata</i>.....	..	..	1	<i>Oithonina nana</i>	f	f	c
<i>Corycaeus clausi</i>	2	..	..	<i>Oncaea curta</i>	r	..	..
<i>crassiusculus</i>.....	..	f	..	<i>media</i>.....	..	..	f
<i>longistylis</i>	r	..	f	<i>minuta</i>.....	..	a	a
<i>pumilus</i>.....	..	..	r	<i>similis</i>	2	..	..
<i>speciosus</i>	f	f	a	<i>venusta</i>.....	..	f	a
<i>typicus</i>.....	..	4	..	<i>Paracalanus aculeatus</i>.....	..	..	2
<i>Eucalanus attenuatus</i>	f	c	f	<i>parvus</i>	f	f	c
<i>elongatus</i>.....	..	c	2	<i>pygmaeus</i>	1	..	..
<i>monachus</i>.....	..	..	r	<i>Pontella tenuiremis</i>	c	..	..
<i>mucronatus</i>	1	f	..	<i>Pseudocalanus minutus</i>	a	f	..
<i>Euchaeta marina</i>	1	a	a	<i>Sapphirina angusta</i>.....	..	1	..
<i>Euchirella brevis</i>.....	..	1	..	<i>metallina</i>.....	..	2	f
<i>Farranula carinata</i>	c	f	..	<i>nigromaculata</i>.....	..	1	..
<i>gibbula</i>	r	..	..	<i>Scolecithrix danae</i>.....	..	c	f
<i>rostrata</i>.....	..	f	..	<i>Undinula darwinii</i>.....	..	c	c
<i>Gaetanus latifrons</i>.....	..	..	1 ♀				

The temperature was high at the surface and dropped 4° in the 100 meters; the salinity increased a trifle with depth, and the hydrogen-ion concentration diminished. Twenty-six species were taken at the surface, 38 in the 50-meter tow, and 45 in the 100-meter tow. Thirty-three species (51 per cent) were each confined to a single tow and 12 were present in all three tows. The 50-meter tow was the shortest of the

three, but its volume was three times as large as that of either of the others. The 100-meter tow contains the only record for *Gaetanus latifrons*, a single female. *Corycaeus*, *Oithona*, and *Oncaea* were distributed at all three depths, but *Farranula* did not appear in the 100-meter tow, nor *Candacia* in the surface tow. The bulk of the 50-meter tow was made up of *Neocalanus* and *Oithona* species.

STATION 138

September 20, 1929; 22° 53' N, 151° 15' W; bottom depth, 5382 m; 57 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	26.1	25.6	22.2	Density (σ_{tP})	22.9	23.2	24.5
Salinity, o/oo	34.8	34.7	34.8	Hydrogen-ion conc. (pH)	8.35	8.29	8.31
Volume of tow, cm ³	32	80	32	Length of tow, miles	2.0	1.8	2.1

<i>Acartia danae</i>	r	c	r	<i>Farranula rostrata</i>	c	..	..
<i>Acrocalanus gibber</i>	2	..	..	<i>Haloptilus longicornis</i>.....	..	1	1
<i>gracilis</i>	c	c	r	<i>spiniceps</i>.....	..	2	..
<i>longicornis</i>	r	f	..	<i>Labidocera detruncata</i>	c	..	..
<i>Aetideus armatus</i>.....	..	1	..	<i>Lucicutia clausii</i>.....	..	..	c
<i>Calanus minor</i>.....	..	f	..	<i>flavicornis</i>.....	..	..	r
<i>Calocalanus pavo</i>	c	f	f	<i>Macrosetella gracilis</i>	f	f	f
<i>styliremis</i>.....	..	2	f	<i>oculata</i>.....	..	1	..
<i>Candacia bispinosa</i>.....	..	f	f	<i>Mecynocera clausi</i>	c	c	c
<i>pachydactyla</i>.....	..	2	..	<i>Megacalanus longicornis</i>.....	..	c	c
<i>simplex</i>.....	..	f	c	<i>princeps</i>.....	..	r	..
<i>Canthocalanus pauper</i>.....	..	3	1	<i>Microsetella rosea</i>	f	f	f
<i>Clausocalanus arcuicornis</i>	c	c	f	<i>Miracia efferata</i>.....	..	2	..
<i>furcatus</i>	2	r	2	<i>Neocalanus gracilis</i>.....	..	a	a
<i>Clytemnestra rostrata</i>.....	..	1	..	<i>robustior</i>.....	..	a	c
<i>scutellata</i>.....	..	..	2	<i>Oithona plumifera</i>.....	..	f	..
<i>Copilia denticulata</i>	r	f	..	<i>similis</i>	c	..	c
<i>Corycaeus agilis</i>	r	..	..	<i>spirostris</i>.....	..	c	f
<i>crassiusculus</i>.....	..	f	f	<i>Oithonina nana</i>	f	c	c
<i>lautus</i>.....	..	..	3	<i>Oncaea minuta</i>.....	..	f	c
<i>longistylis</i>	f	f	..	<i>venusta</i>	a	a	a
<i>pacificus</i>.....	..	2	..	<i>Paracalanus parvus</i>	c	c	c
<i>speciosus</i>	c	a	c	<i>Pleuromamma robusta</i>.....	..	..	1 ♀
<i>typicus</i>	f	..	..	<i>Pontella securifer</i>	f	..	..
<i>Eucalanus elongatus</i>.....	..	1	..	<i>tenuiremis</i>	f	..	..
<i>Euchaeta acuta</i>.....	..	f	..	<i>Pseudocalanus minutus</i>.....	..	c	c
<i>marina</i>.....	..	c	c	<i>Scolecithrix danae</i>.....	..	3	..
<i>Euchirella curticauda</i>.....	..	2	..	<i>Undinula darwinii</i>.....	..	f	f
<i>Farranula carinata</i>	a	f	c				

The temperature was high at the surface and fell 4° in the 100 meters; the salinity and hydrogen-ion concentration changed but little. Twenty-four species were taken at the surface, 43 in the 50-meter tow, and 34 in the 100-meter tow.

Twenty-six species (46 per cent) were each present in a single tow and 12 in all three tows. *Corycaeus*, *Farranula*, *Oithona*, and *Oncaea* appeared at all depths and the rare species *Pleuromamma robusta*, a single female, at 100 meters.

STATION 139

September 22, 1929; 21° 47' N, 155° 31' W; bottom depth, 5030 m; 62 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	26.7	25.7	22.3	Density (σ_{tp})	22.6	23.2	24.7
Salinity, ‰	34.8	34.8	35.1	Hydrogen-ion conc. (pH)	8.34	8.31	8.28
Volume of tow, cm ³	80	48	32	Length of tow, miles	1.3	1.3	1.4

<i>Acartia danae</i>	f	r	f	<i>Farranula rostrata</i>	c	..	..
<i>Acrocalanus gibber</i>	f	..	..	<i>Haloptilus longicornis</i>.....	..	..	1
<i>gracilis</i>	a	c	..	<i>spiniceps</i>.....	..	1	..
<i>longicornis</i>	f	2	..	<i>Labidocera detruncata</i>	f	..	..
<i>monachus</i>.....	..	f	..	<i>Lubbockia squillimana</i>.....	..	1	..
<i>Aetideus armatus</i>.....	..	..	1	<i>Lucicutia clausii</i>.....	..	1	a
<i>Calanus minor</i>.....	..	f	..	<i>flavicornis</i>	1	..	..
<i>Calocalanus pavo</i>	r	2	f	<i>Macrosetella gracilis</i>	c	c	f
<i>styliremis</i>	1	..	2	<i>oculata</i>.....	..	..	1
<i>Candacia bispinosa</i>.....	..	..	f	<i>Mecynocera clausi</i>.....	..	f	c
<i>simplex</i>.....	..	c	f	<i>Microcalanus pusillus</i>.....	..	f	r
<i>Centropages calaninus</i>.....	..	3	..	<i>pygmaeus</i>.....	..	f	r
<i>elongatus</i>.....	..	r	..	<i>Microsetella rosea</i>	c	c	r
<i>Clausocalanus arcuicornis</i>.....	..	c	f	<i>Neocalanus gracilis</i>	f	c	a
<i>furcatus</i>	f	..	f	<i>tenuicornis</i>	c	c	c
<i>Clytemnestra rostrata</i>.....	..	1	..	<i>Oithona plumifera</i>	f	a	..
<i>Copilia denticulata</i>.....	..	f	1	<i>similis</i>	c	c	..
<i>quadrata</i>.....	..	2	2	<i>spirostris</i>.....	..	f	f
<i>Corycaeus clausi</i>.....	..	3	..	<i>Oithonina nana</i>.....	..	..	f
<i>crassiusculus</i>	f	f	..	<i>Oncaea minuta</i>.....	..	a	c
<i>flaccus</i>	r	..	..	<i>tenella</i>	3	..	1
<i>longistylis</i>	f	c	..	<i>venusta</i>	c	a	a
<i>pacificus</i>.....	..	..	3	<i>Paracalanus parvus</i>	c	c	c
<i>speciosus</i>	c	a	a	<i>pygmaeus</i>.....	..	f	r
<i>typicus</i>.....	..	..	r	<i>Pontellina plumata</i>	1	..	..
<i>Eucalanus attenuatus</i>.....	..	c	f	<i>Pseudocalanus minutus</i>.....	..	c	c
<i>elongatus</i>.....	..	f	..	<i>Sapphirina auronitens</i>	2	2	1
<i>Euchaeta marina</i>.....	..	c	f	<i>metallina</i>.....	..	..	c
<i>Euchirella curticauda</i>.....	..	r	..	<i>nigromaculata</i>.....	..	2	..
<i>Farranula carinata</i>	a	c	..	<i>Scolecithricella bradyi</i>.....	..	..	3
<i>gibbula</i>.....	..	r	..	<i>Undinula darwinii</i>.....	..	f	..

The temperature was high at the surface and fell 4° in 100 meters; the salinity and hydrogen-ion concentration changed very little. Twenty-six species were taken at the surface, 44 in the 50-meter tow, and 36 in the 100-meter tow. Twenty-eight species (45 per cent) were each confined to a single tow and 10 were present in all three tows. *Corycaeus*,

Oithona, and *Oncaea* were each distributed at all three depths, but *Farranula* did not appear in the 100-meter tow. The three tows were of practically the same length, but the volume of the surface tow was as large as the combined volumes of the other two. *Oithona plumifera* was especially abundant in the 50-meter tow.

STATION 140

October 3, 1929; 23° 26' N, 159° 27' W; bottom depth, 4762 m; 46 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	26.9	26.9	25.5	Density (σ_{tP})	22.8	23.0	23.6
Salinity, o/oo	35.0	35.0	35.0	Hydrogen-ion conc. (pH)	8.42	8.39	8.34
Volume of tow, cm ³	96	64	32	Length of tow, miles	2.1	2.1	2.1

<i>Acartia danae</i>	f	f	c	<i>Farranula rostrata</i>.....	..	..	f
<i>Acrocalanus gibber</i>.....	..	r	..	<i>Labidocera detruncata</i>	f	..	..
<i>gracilis</i>	f	c	f	<i>Lucicutia clausii</i>.....	..	..	1
<i>longicornis</i>.....	..	..	r	<i>Macrosetella gracilis</i>.....	..	3	f
<i>Calanus minor</i>.....	..	f	f	<i>Mecynocera clausi</i>.....	..	..	f
<i>propinquus</i>.....	..	1	..	<i>Microsetella rosea</i>.....	..	c	c
<i>Calocalanus pavo</i>.....	..	2	2	<i>Neocalanus gracilis</i>.....	..	..	f
<i>styliremis</i>.....	..	..	2	<i>tenuicornis</i>.....	..	..	f
<i>Candacia simplex</i>	1	f	f	<i>Oithona attenuata</i>.....	..	..	2
<i>Centropages calaninus</i>.....	..	1	..	<i>plumifera</i>.....	..	..	2
<i>Clausocalanus arcuicornis</i>.....	..	c	c	<i>similis</i>	1	c	c
<i>furcatus</i>	f	c	f	<i>spinirostris</i>.....	..	..	f
<i>Copilia denticulata</i>	1	2	2	<i>Oncaea minuta</i>.....	..	c	..
<i>Corycaeus crassiusculus</i>	f	c	r	<i>venusta</i>	a	a	a
<i>furcifer</i>.....	..	r	3	<i>Paracalanus parvus</i>.....	..	c	c
<i>longistylis</i>	f	2	..	<i>pygmaeus</i>.....	..	..	f
<i>speciosus</i>	a	a	c	<i>Pontella cristata</i>	2	..	..
<i>typicus</i>	r	..	..	<i>tenuiremis</i>	1	..	..
<i>Euchaeta acuta</i>.....	..	..	f	<i>Pontellina plumata</i>.....	..	1	..
<i>marina</i>	1	f	c	<i>Pseudocalanus minutus</i>	f	c	f
<i>Euchirella curticauda</i>.....	..	r	..	<i>Scolecithrix danae</i>.....	..	f	c
<i>Farranula carinata</i>	a	c	c	<i>Undinula darwinii</i>.....	..	f	c
<i>curta</i>	f	..	..	<i>vulgaris</i>.....	..	..	1

The temperature was high at the surface and fell about 1.5 in 100 meters; the salinity and hydrogen-ion concentration remained almost unchanged. Eighteen species were taken at the surface, 28 in the 50-meter tow, and 34 in the 100-meter tow. Twenty-four species (52 per cent) were each confined to a single tow and 11 were present in all three

tows. *Candacia*, *Corycaeus*, *Farranula*, *Oithona*, and *Oncaea* were each distributed in all three tows, an exceptional record for *Candacia*. The three tows were of exactly the same length, but the volume of the surface tow was one-half larger than that of the 50-meter tow and three times that of the 100-meter tow.

STATION 141

October 5, 1929; 29° 02' N, 161° 11' W; bottom depth, 5667 m; 56 species

Depth of tow, m	0	50	Depth of tow, m	0	50
Temperature, °C	25.8	24.7	Density (σ_{tP})	23.2	23.8
Salinity, o/oo	35.1	35.2	Hydrogen-ion concentration (pH)	8.34	8.34
Volume of tow, cm ³	32	48	Length of tow, miles	2.4	2.1

<i>Acartia danae</i>	f	..	<i>Macrosetella gracilis</i>	c	f
<i>Acrocalanus gibber</i>	1	..	<i>oculata</i>.....	..	2
<i>gracilis</i>	f	c	<i>Mecynocera clausi</i>.....	..	a
<i>longicornis</i>	2	..	<i>Megacalanus longicornis</i>.....	..	f
<i>Calanus minor</i>.....	..	c	<i>Microcalanus pusillus</i>.....	..	r
<i>Calocalanus pavo</i>	f	f	<i>Microsetella rosea</i>	f	f
<i>styliremis</i>	2	..	<i>Miracia efferata</i>	f	..
<i>Candacia bispinosa</i>.....	..	1	<i>Neocalanus gracilis</i>	f	a
<i>simplex</i>.....	..	r	<i>robustior</i>.....	..	f
<i>Centropages calaninus</i>	2	..	<i>tenuicornis</i>.....	..	a
<i>Clausocalanus arcuicornis</i>.....	..	c	<i>Oithona attenuata</i>.....	..	c
<i>furcatus</i>.....	..	c	<i>plumifera</i>.....	..	f
<i>Clytemnestra scutellata</i>.....	..	1	<i>similis</i>	f	..
<i>Copilia denticulata</i>	2	3	<i>Oithonina nana</i>.....	..	c
<i>quadrata</i>	1	..	<i>Oncaea media</i>.....	..	f
<i>Corycaeus crassiusculus</i>	r	..	<i>minuta</i>	c	..
<i>lautus</i>.....	..	3	<i>notopa</i>	3	..
<i>longistylis</i>	c	f	<i>venusta</i>	a	a
<i>pumilus</i>	2	..	<i>Paracalanus aculeatus</i>.....	..	1
<i>speciosus</i>	a	f	<i>parvus</i>	c	c
<i>Eucalanus attenuatus</i>.....	..	r	<i>pygmaeus</i>.....	..	f
<i>Euchaeta acuta</i>.....	..	c	<i>Pareuchaeta tonsa</i>.....	..	1 ♀
<i>marina</i>.....	..	c	<i>Pontella tenuiremis</i>	1	..
<i>Euchirella curticauda</i>.....	..	1	<i>Pseudocalanus minutus</i>.....	..	c
<i>Farranula carinata</i>	a	c	<i>Sapphirina auronitens</i>	3	..
<i>gibbula</i>	f	..	<i>nigromaculata</i>.....	..	2
<i>rostrata</i>.....	..	f	<i>Scolecithrix danae</i>.....	..	a
<i>Labidocera detruncata</i>	r	..	<i>Undinula darwinii</i>.....	..	c

The temperature was high at the surface and dropped 1° at the 50-meter level; the salinity and hydrogen-ion concentration were practically the same at both depths. Twenty-seven species were taken at the surface and 40 in the 50-meter tow. Forty-five species (80 per cent) each appeared in one tow and not in the other, and 11 were present in both

tows. Although shorter than the surface tow, the 50-meter tow had a volume 50 per cent larger. *Corycaeus*, *Farranula*, *Oithona*, and *Oncaea* each appeared in both tows, but *Candacia* and *Euchaeta* were not present in the surface tow. *Farranula carinata* was especially abundant in the surface tow.

STATION 142

October 7, 1929; 32° 42' N, 160° 44' W; bottom depth, 5787 m; 58 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	24.0	21.8	16.5	Density (σ_{tP})	23.5	24.3	25.6
Salinity, o/oo	34.8	34.7	34.4	Hydrogen-ion conc. (pH)	8.33	8.30	8.27
Volume of tow, cm ³	48	32	48	Length of tow, miles	0.8	0.8	0.8

<i>Acartia danae</i>.....	..	f	c	<i>Labidocera detruncata</i>	a	r	f
<i>Acrocalanus gracilis</i>	f	..	r	<i>Lubbockia aculeata</i>.....	..	..	r
<i>longicornis</i>	2	..	..	<i>squillimana</i>.....	..	..	f
<i>Calanus minor</i>	2	a	c	<i>Lucicutia clausii</i>.....	..	1	f
<i>Calocalanus pavo</i>.....	..	r	f	<i>Macrosetella gracilis</i>.....	..	..	2
<i>styliremis</i>.....	..	r	3	<i>oculata</i>.....	..	..	1
<i>Candacia aethiopica</i>.....	..	..	1	<i>Mecynocera clausi</i>.....	..	a	c
<i>simplex</i>	1	f	f	<i>Microcalanus pusillus</i>.....	..	..	3
<i>Canthocalanus pauper</i>.....	..	1	..	<i>pygmaeus</i>.....	..	..	f
<i>Centropages calaninus</i>.....	..	..	3	<i>Microsetella rosea</i>.....	..	1	f
<i>Clausocalanus arcuicornis</i>	c	f	c	<i>Neocalanus gracilis</i>	2	a	c
<i>furcatus</i>.....	..	..	f	<i>robustior</i>.....	..	..	f
<i>Clytemnestra rostrata</i>.....	..	..	c	<i>tenuicornis</i>.....	..	a	c
<i>scutellata</i>.....	..	1	f	<i>Oithona plumifera</i>.....	..	..	f
<i>Corycaeus catus</i>	2	..	..	<i>similis</i>.....	..	c	a
<i>crassiusculus</i>.....	..	..	f	<i>Oncaea curta</i>.....	..	..	f
<i>limbatus</i>.....	..	r	..	<i>media</i>.....	..	f	..
<i>longistylis</i>.....	..	..	c	<i>minuta</i>.....	..	2	a
<i>robustus</i>.....	..	..	2	<i>venusta</i>	3	..	a
<i>speciosus</i>.....	..	f	..	<i>Pachos punctatum</i>.....	..	..	2
<i>typicus</i>.....	..	..	r	<i>Paracalanus parvus</i>	a	c	a
<i>Eucalanus attenuatus</i>.....	..	1	2	<i>pygmaeus</i>.....	..	..	f
<i>Euchaeta marina</i>.....	..	r	3	<i>Pontellina plumata</i>	f	..	..
<i>Farranula carinata</i>	a	c	a	<i>Pseudocalanus minutus</i>	c	c	c
<i>gibbula</i>	f	..	..	<i>Sapphirina auronitens</i>	3	..	..
<i>rostrata</i>.....	..	f	..	<i>metallina</i>.....	..	..	f
<i>Haloptilus acutifrons</i>.....	..	..	1	<i>Scolecithrix danae</i>.....	..	..	f
<i>longicornis</i>.....	..	1	f	<i>Undinula darwinii</i>.....	..	..	f
<i>Labidocera acutifrons</i>	2	..	..	<i>Vettopia granulosa</i>.....	..	..	2

The temperature was high at the surface and dropped 7°5 in the 100 meters; the salinity and hydrogen-ion concentration both diminished slightly. Sixteen species were found at the surface, 26 in the 50-meter tow, and 47 in the 100-meter tow. Thirty-six species (62 per cent) were each confined to a single tow and 8 were present in all three tows. *Farranula*

was found at all three depths, but only a single species each of *Corycaeus* and *Oncaea* and none of *Oithona* was present in the surface tow. *Labidocera detruncata* was especially abundant at the surface, adults as well as many development stages. The presence of this species in all three tows is worthy of note as it is usually confined to the surface.

STATION 143

October 9, 1929; 34° 06' N, 157° 09' W; bottom depth, 5841 m; 33 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	22.4	19.0	13.8	Density ($\sigma_{t,p}$)	23.6	24.6	26.0
Salinity, o/oo	34.3	34.2	34.1	Hydrogen-ion conc. (pH)	8.30	8.30	8.28
Volume of tow, cm ³	32	32	32	Length of tow, miles	1.4	1.0	1.1

<i>Acartia danae</i>	f	f	..	<i>Eucalanus elongatus</i>.....	..	..	c
<i>longiremis</i>	1	..	..	<i>Labidocera acutifrons</i>	1	..	..
<i>Acrocalanus gracilis</i>	2	..	..	<i>detruncata</i>	a	..	f
<i>Calanus minor</i>	f	a	a	<i>Mecynocera clausi</i>	c	a	a
<i>Candacia aethiopica</i>.....	..	a	c	<i>Megacalanus longicornis</i>.....	..	f	1
<i>Canthocalanus pauper</i>.....	..	f	f	<i>Microsetella rosea</i>.....	..	..	f
<i>Centropages calaninus</i>.....	..	1	2	<i>Neocalanus gracilis</i>	2	a	a
<i>Clausocalanus arcuicornis</i>	f	..	c	<i>robustior</i>.....	..	c	c
<i>furcatus</i>.....	..	..	2	<i>tenuicornis</i>.....	..	c	..
<i>Clytemnestra rostrata</i>.....	..	..	f	<i>Oithona similis</i>	f	f	c
<i>Copilia quadrata</i>.....	..	..	1	<i>Oithonina nana</i>	f	r	f
<i>Corycaeus crassiusculus</i>.....	..	..	f	<i>Oncaea venusta</i>.....	..	..	f
<i>longistylis</i>.....	..	..	f	<i>Paracalanus parvus</i>.....	..	f	f
<i>pacificus</i>	1	..	..	<i>Pseudocalanus minutus</i>	f	..	..
<i>pumilus</i>.....	..	..	r	<i>Undinula darwinii</i>.....	..	1	..
<i>typicus</i>.....	..	3	..	<i>vulgaris</i>.....	..	..	1
<i>Eucalanus attenuatus</i>.....	..	..	1				

The temperature was a little lower at the surface than at station 142 and fell 8.5 in the 100 meters; the salinity and hydrogen-ion concentration diminished a trifle. Thirteen species were taken at the surface, 15 in the 50-meter tow, and 23 in the 100-meter tow. Twenty species (60 per cent) were each confined to a single tow and 5 were present in all

three tows. The lengths of the three tows varied from 10 to 30 per cent, but the volumes were exactly the same. *Corycaeus* and *Oithona* were sparsely distributed in all three tows, but more abundantly in the 100-meter tow. *Farranula* was absent, and *Oncaea* appeared only in the deepest tow. Males of *Labidocera detruncata* were abundant at the surface.

STATION 144

October 11, 1929; 33° 38' N, 151° 47' W; bottom depth, 5523 m; 12 species

<i>Acartia danae</i>	f	<i>Labidocera acutifrons</i>	c	<i>Microsetella rosea</i>	f
<i>Candacia aethiopica</i>	r	<i>detruncata</i>	a	<i>Oithona similis</i>	r
<i>Corycaeus speciosus</i>	f	<i>nerii</i>	c	<i>Pontella tenuiremis</i>	c
<i>Farranula carinata</i>	f	<i>Mecynocera clausi</i>	r	<i>Pontellopsis villosa</i>	r

Temperature, 23.2 C; salinity, 34.9 o/oo; density, 23.8; hydrogen-ion concentration, 8.37; volume of tow, 64 cm³; length, 2 miles. Only the surface tow was saved; it was note-

worthy for the exceptional abundance of *Labidocera detruncata*, including a great many development stages, and for the only *Pontellopsis villosa* of the entire cruise.

STATION 145

October 13, 1929; 33° 27' N, 145° 30' W; bottom depth, 5584 m; 41 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	22.2	18.7	15.9	Density ($\sigma_{t,p}$)	23.8	24.8	25.5
Salinity, o/oo	34.6	34.3	34.1	Hydrogen-ion conc. (pH)	8.29	8.34	8.31
Volume of tow, cm ³	32	64	64	Length of tow, miles	0.3	0.7	0.8

<i>Acartia danae</i>	a	c	c	<i>Lucicutia flavicornis</i>.....	..	..	f
<i>Calanus minor</i>.....	..	c	c	<i>Macrosetella gracilis</i>.....	..	2	2
<i>Candacia aethiopica</i>	c	..	..	<i>Mecynocera clausi</i>.....	..	a	f
<i>simplex</i>.....	..	c	r	<i>Megacalanus longicornis</i>.....	..	f	..
<i>Canthocalanus pauper</i>.....	..	..	f	<i>Microsetella rosea</i>.....	..	f	c
<i>Centropages calaninus</i>.....	..	..	2	<i>Miracia efferata</i>.....	..	..	1
<i>elongatus</i>.....	..	f	..	<i>Neocalanus gracilis</i>	c	f	..
<i>Clausocalanus arcuicornis</i>	f	c	c	<i>robustior</i>.....	..	..	2
<i>Clytemnestra rostrata</i>.....	..	..	f	<i>tenuicornis</i>.....	..	f	c
<i>Copilia denticulata</i>.....	..	2	..	<i>Oithona similis</i>.....	..	..	c
<i>quadrata</i>.....	..	2	..	<i>Oncaea minuta</i>.....	..	..	a
<i>Corycaeus longistylis</i>.....	..	c	..	<i>venusta</i>	f	a	a
<i>speciosus</i>	f	a	..	<i>Pachos tuberosum</i>.....	..	2	1
<i>Eucalanus attenuatus</i>.....	..	..	1	<i>Paracalanus parvus</i>.....	..	..	c
<i>elongatus</i>.....	..	f	..	<i>Pontellina plumata</i>.....	..	1	..
<i>Euchirella curticauda</i>.....	..	..	1	<i>Pseudocalanus minutus</i>	f	f	c
<i>pulchra</i>.....	..	1	..	<i>Sapphirina metallina</i>.....	..	c	..
<i>Farranula carinata</i>	r	..	..	<i>nigromaculata</i>.....	..	r	..
<i>rostrata</i>	f	..	..	<i>Undeuchaeta plumosa</i>.....	..	..	1
<i>Haloptilus longicornis</i>.....	..	..	1	<i>Undinula darwinii</i>.....	..	..	f
<i>Labidocera detruncata</i>	c	..	..		

The temperature was high at the surface and fell 6.3 in the 100 meters; the salinity diminished and the hydrogen-ion concentration increased slightly. Ten species were taken at the surface, 23 in the 50-meter tow, and 25 in the 100-meter tow. Twenty-eight species (70 per cent) were each confined to a single tow and 4 were present in all three tows. The two

deeper tows were a little more than twice the length of the surface tow and their volume was twice as large. *Corycaeus* did not appear in the 100-meter tow, *Farranula* was confined to the surface tow, *Oithona* was found only in the 100-meter tow, and *Candacia* and *Oncaea* were distributed at all three depths.

STATION 146
October 15, 1929; 31° 51' N, 140° 50' W; bottom depth, 4756 m; 59 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	22.3	22.3	19.7	Density (σ_{t})	24.0	24.3	24.8
Salinity, ‰	34.8	34.9	34.3	Hydrogen-ion conc. (pH)	8.37	8.30	8.26
Volume of tow, cm ³	48	32	48	Length of tow, miles	1.4	1.5	1.4

<i>Acartia danae</i>	f	c	c	<i>Labidocera nerii</i>.....	..	..	3
<i>negligens</i>.....	..	r	..	<i>Lubbockia squillimana</i>.....	..	f	f
<i>Acrocalanus gracilis</i>	2	f	..	<i>Lucicutia clausii</i>.....	..	f	f
<i>longicornis</i>.....	..	3	..	<i>flavicornis</i>.....	..	c	c
<i>Calanus minor</i>	f	c	c	<i>Macrosetella gracilis</i>.....	..	2	2
<i>Calocalanus pavo</i>	1	c	f	<i>Mecynocera clausi</i>.....	..	c	c
<i>Candacia simplex</i>	f	f	f	<i>Megacalanus longicornis</i>.....	..	f	f
<i>Centropages calaninus</i>	r	..	..	<i>Microcalanus pusillus</i>.....	..	c	f
<i>elongatus</i>.....	..	2	1	<i>pygmaeus</i>.....	..	r	f
<i>violaceus</i>.....	..	r	..	<i>Microsetella norvegica</i>.....	..	..	1
<i>Clausocalanus arcuicornis</i>	r	c	c	<i>rosea</i>.....	..	f	f
<i>Clytemnestra rostrata</i>.....	..	..	a	<i>Neocalanus gracilis</i>	f	a	a
<i>scutellata</i>.....	..	f	a	<i>robustior</i>.....	..	2	..
<i>Copilia quadrata</i>.....	..	..	2	<i>tenuicornis</i>.....	..	a	a
<i>Corycaeus crassiusculus</i>.....	..	..	f	<i>Oithona similis</i>.....	..	c	c
<i>lautus</i>.....	..	..	3	<i>spinirostris</i>.....	..	f	..
<i>longistylis</i>.....	..	..	a	<i>Oncaea minuta</i>	2	c	a
<i>ovalis</i>.....	..	r	..	<i>venusta</i>.....	..	a	a
<i>pumilus</i>	2	..	..	<i>Paracalanus parvus</i>.....	..	c	c
<i>speciosus</i>	f	a	a	<i>pygmaeus</i>.....	..	f	..
<i>typicus</i>	r	..	..	<i>Pseudocalanus minutus</i>	f	..	c
<i>Eucalanus elongatus</i>.....	..	..	r	<i>Sapphirina auronitens</i>.....	..	..	1
<i>Euchaeta acuta</i>.....	..	..	f	<i>metallina</i>.....	..	..	c
<i>marina</i>	1	..	f	<i>nigromaculata</i>.....	..	..	1
<i>Farranula carinata</i>	c	a	..	<i>opalina</i>	1	..	..
<i>curta</i>.....	..	..	r	<i>Scolecithricella marginata</i>.....	..	2	..
<i>rostrata</i>.....	..	..	f	<i>Scolecithrix danae</i>.....	..	..	r
<i>Haloptilus longicornis</i>.....	..	a	a	<i>Undinula caroli</i>.....	..	f	..
<i>Labidocera acutifrons</i>	a	..	f	<i>darwinii</i>.....	..	f	f
<i>detruncata</i>	a	f	f				

The temperature was high at the surface and fell 2°6 in the 100 meters; the salinity and hydrogen-ion concentration each diminished a little. Eighteen species were taken at the surface, 37 in the 50-meter tow, and 44 in the 100-meter tow. Twenty-eight species (47 per cent) were each confined to a single tow and 9 were present at all three depths. *Candacia*,

Corycaeus, *Farranula*, and *Oncaea* were found in each of the tows, but *Oithona* did not appear at the surface. The 50-meter tow was one of 12 net hauls containing *Scolecithricella marginata*; the others were made at stations 35-36 (b), 39, 44, 114, 152, 153, 156, 158, 159. *Labidocera detruncata* was again extremely abundant at the surface.

STATION 147

October 17, 1929; 27° 27' N, 138° 14' W; bottom depth, 4840 m; 67 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	23.3	23.1	19.1	Density (σ_{tP})	24.0	24.3	25.4
Salinity, ‰	35.2	35.2	35.0	Hydrogen-ion conc. (pH)	8.26	8.27	8.29
Volume of tow, cm ³	32	32	64	Length of tow, miles	0.9	0.8	0.8

<i>Acartia clausii</i>.....	..	3	..	<i>Labidocera detruncata</i>	a	2	1
<i>danae</i>.....	..	c	c	<i>Lubbockia aculeata</i>.....	..	..	4
<i>Acrocalanus gibber</i>.....	..	..	1	<i>squillimana</i>.....	..	..	c
<i>gracilis</i>	2	f	c	<i>Lucicutia clausii</i>.....	..	..	a
<i>Actideus armatus</i>.....	..	..	f	<i>flavicornis</i>.....	..	..	a
<i>Calanus minor</i>.....	..	..	f	<i>Mecynocera clausi</i>.....	..	c	c
<i>propinquus</i>.....	..	2	..	<i>Megacalanus longicornis</i>	1	..	f
<i>Calocalanus pavo</i>.....	..	..	c	<i>Microcalanus pusillus</i>.....	..	..	c
<i>styliremis</i>.....	..	2	..	<i>pygmaeus</i>	1	..	2
<i>Candacia bispinosa</i>.....	..	c	c	<i>Microsetella rosea</i>.....	..	f	c
<i>simplex</i>.....	..	f	f	<i>Neocalanus gracilis</i>.....	..	a	..
<i>Canthocalanus pauper</i>.....	..	..	2	<i>robustior</i>.....	..	3	..
<i>Centropages elongatus</i>.....	..	..	f	<i>tenuicornis</i>.....	..	..	a
<i>Clausocalanus arcuicornis</i>	3	a	a	<i>Oithona similis</i>.....	..	c	..
<i>furcatus</i>.....	..	f	f	<i>spinirostris</i>.....	..	c	..
<i>Clytemnestra rostrata</i>.....	..	..	f	<i>Oithonina nana</i>.....	..	..	c
<i>scutellata</i>.....	..	f	c	<i>Oncaea media</i>	f	..	..
<i>Copilia quadrata</i>.....	..	..	2	<i>minuta</i>.....	..	..	a
<i>vitrea</i>.....	..	..	1	<i>notopa</i>.....	..	r	..
<i>Corycaeus catus</i>	2	..	..	<i>similis</i>.....	..	c	r
<i>crassiusculus</i>	2	..	f	<i>venusta</i>	f	a	a
<i>dubius</i>.....	..	2	..	<i>Paracalanus aculeatus</i>.....	..	r	1
<i>robustus</i>.....	..	3	1	<i>parvus</i>	f	c	c
<i>speciosus</i>	f	a	a	<i>pygmaeus</i>.....	..	f	c
<i>typicus</i>.....	..	..	r	<i>Pareuchaeta tonsa</i>.....	..	..	2 ♀
<i>Eucalanus attenuatus</i>.....	..	1	r	<i>Pseudocalanus minutus</i>	2	c	c
<i>elongatus</i>.....	..	..	f	<i>Sapphirina auronitens</i>.....	..	1	..
<i>Euchaeta acuta</i>.....	..	..	2	<i>metallina</i>.....	..	..	a
<i>marina</i>.....	..	f	f	<i>opalina</i>	1	..	..
<i>Euchirella curticauda</i>.....	..	..	1	<i>Scolecithricella auropecten</i>.....	..	..	2
<i>Farranula carinata</i>	c	f	c	<i>Scolecithrix danae</i>.....	..	2	2
<i>gibbula</i>.....	..	r	..	<i>Undinula caroli</i>.....	..	..	r
<i>rostrata</i>.....	..	..	f	<i>darwinii</i>.....	..	..	f
<i>Haloptilus longicornis</i>.....	..	..	a				

The temperature was fairly high at the surface and fell 4.2 in the 100 meters; the salinity diminished and the hydrogen-ion concentration increased very slightly. Fourteen species were captured at the surface, 33 in the 50-meter tow, and 53 in the 100-meter tow. Forty-three species (64 per cent) were each confined to a single depth and 8 were distributed at all three depths. The length of the three tows was practically the same, but the volume of the 100-meter tow was

twice as large as that of either of the others. *Corycaeus*, *Farranula*, and *Oncaea* were present in each of the tows, but *Candacia* and *Oithona* did not appear at the surface. In the surface tow the *Labidocera detruncata* were almost entirely adult males and development stages. These being abundant at the surface, in all probability the 2 specimens recorded for the 50-meter tow and the 1 specimen for the 100-meter tow got into the net while it was being lowered or raised.

STATION 148

October 19, 1929; 24° 57' N, 137° 44' W; bottom depth, 4835 m; 58 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	23.4	23.0	19.9	Density (σ_{tP})	23.9	24.2	25.2
Salinity, o/oo	35.1	35.1	34.9	Hydrogen-ion conc. (pH)	....	....	....
Volume of tow, cm ³	32	....	64	Length of tow, miles	1.8	....	2.0

<i>Acartia danae</i>	r	r	a	<i>Lucicutia clausii</i>.....	..	..	c
<i>Acrocalanus gracilis</i>	r	r	c	<i>flavicornis</i>.....	..	..	a
<i>longicornis</i>.....	..	..	c	<i>Macrosetella gracilis</i>.....	..	..	2
<i>Aetideus armatus</i>.....	..	..	f	<i>oculata</i>.....	..	..	1
<i>Calanus minor</i>.....	..	..	c	<i>Mecynocera clausi</i>.....	..	c	c
<i>Calocalanus pavo</i>.....	..	r	3	<i>Megacalanus longicornis</i>.....	..	f	c
<i>styliremis</i>.....	..	1	..	<i>Microcalanus pusillus</i>.....	..	..	f
<i>Candacia bispinosa</i>.....	..	..	c	<i>Microsetella rosea</i>	r	r	..
<i>simplex</i>	r	..	c	<i>Neocalanus gracilis</i>.....	..	f	c
<i>Canthocalanus pauper</i>.....	..	..	f	<i>robustior</i>.....	..	2	f
<i>Centropages calaninus</i>	r	..	f	<i>tenuicornis</i>.....	..	f	a
<i>Clausocalanus arcuicornis</i>	r	f	a	<i>Oithona plumifera</i>.....	..	f	..
<i>furcatus</i>.....	..	..	f	<i>similis</i>	1	c	a
<i>Clytemnestra scutellata</i>.....	..	..	3	<i>spirostris</i>.....	..	f	c
<i>Copilia quadrata</i>.....	..	..	r	<i>Oncaea minuta</i>.....	..	..	a
<i>Corycaeus clausi</i>	2	..	..	<i>tenella</i>.....	..	r	..
<i>flaccus</i>.....	..	r	..	<i>venusta</i>	f	c	..
<i>lautus</i>.....	..	..	3	<i>Paracalanus parvus</i>.....	..	f	..
<i>speciosus</i>	f	c	c	<i>pygmaeus</i>	r	f	r
<i>typicus</i>.....	..	2	..	<i>Pleuromamma robusta</i>.....	..	..	3
<i>Eucalanus elongatus</i>.....	..	..	r	<i>Pseudocalanus minutus</i>	r	f	..
<i>Euchaeta marina</i>.....	..	r	c	<i>Sapphirina auronitens</i>	2	..	..
<i>Euchirella curticauda</i>.....	..	..	r	<i>metallina</i>.....	..	..	f
<i>Farranula carinata</i>	f	..	a	<i>opalina</i>	r	..	..
<i>rostrata</i>.....	..	..	f	<i>Scolecithricella auropecten</i>.....	..	..	2
<i>Haloptilus longicornis</i>.....	..	..	a	<i>bradyi</i>.....	..	1	..
<i>Labidocera detruncata</i>	a	..	..	<i>Scolecithrix danae</i>.....	..	1	..
<i>Lubbockia aculeata</i>.....	..	..	3	<i>Undinula caroli</i>.....	..	r	3
<i>squillimana</i>.....	..	..	f	<i>darwinii</i>.....	..	1	f

The temperature was fairly high at the surface and fell 3.5 in the 100 meters, and the salinity diminished a little. Sixteen species were taken at the surface, 27 in the 50-meter tow, and 43 in the 100-meter tow. Thirty-five species (60 per cent) were each confined to a single depth and 6 were

present at all three depths. *Corycaeus*, *Oithona*, and *Oncaea* were found in each of the tows, but *Farranula* and *Candacia* were absent from the 50-meter tow. *Labidocera detruncata*, as at the several preceding stations, was very abundant at the surface.

STATION 149

October 21, 1929; 21° 18' N, 138° 36' W; bottom depth, 5320 m; 71 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	23.4	23.3	20.3	Density (σ_{tP})	23.8	24.1	25.0
Salinity, o/oo	35.0	35.0	34.9	Hydrogen-ion conc. (pH)	8.34	8.35	8.38
Volume of tow, cm ³	32	32	48	Length of tow, miles	1.6	1.7	1.7

<i>Acartia danae</i>	a	a	a	<i>Lubbockia aculeata</i>.....	..	r	r
<i>longiremis</i>.....	..	2	2	<i>squillimana</i>.....	..	f	f
<i>Acrocalanus gibber</i>.....	..	..	r	<i>Lucicutia clausii</i>.....	..	..	a
<i>gracilis</i>	c	c	c	<i>flavicornis</i>.....	..	..	a
<i>longicornis</i>.....	..	2	c	<i>Macrosetella gracilis</i>	2	2	a
<i>Aetideus armatus</i>.....	..	..	f	<i>Mecynocera clausi</i>.....	..	c	a
<i>Calanus minor</i>.....	..	f	f	<i>Megacalanus longicornis</i>.....	..	c	2
<i>propinquus</i>.....	..	..	1	<i>Microcalanus pusillus</i>.....	..	..	f
<i>Calocalanus pavo</i>	f	c	..	<i>pygmaeus</i>	r	..	f
<i>plumulosus</i>.....	..	..	2	<i>Microsetella rosea</i>	c	a	c
<i>styliremis</i>.....	..	2	r	<i>Miracia efferata</i>.....	..	2	..
<i>Candacia aethiopica</i>	2	1	2	<i>Neocalanus gracilis</i>.....	..	..	a
<i>bispinosa</i>.....	..	c	f	<i>robustior</i>	1	1	2
<i>simplex</i>	c	a	f	<i>tenuicornis</i>.....	..	..	a
<i>Canthocalanus pauper</i>.....	..	f	f	<i>Oithona plumifera</i>.....	..	..	a
<i>Centropages calaninus</i>	f	a	..	<i>similis</i>	c	c	c
<i>elongatus</i>	2	3	f	<i>spirostris</i>.....	..	f	c
<i>violaceus</i>.....	..	..	f	<i>Oncaea curta</i>.....	..	r	..
<i>Clausocalanus arcuicornis</i>.....	..	a	c	<i>minuta</i>.....	..	..	a
<i>furcatus</i>.....	..	f	..	<i>notopa</i>	r	..	..
<i>Clytemnestra scutellata</i>.....	..	r	1	<i>subtilis</i>.....	..	2	..
<i>Copilia denticulata</i>.....	..	..	1	<i>venusta</i>.....	..	a	a
<i>quadrata</i>.....	..	..	2	<i>Onchocalanus nudipes</i> , n. sp.....	..	3	2
<i>Corycaeus crassiusculus</i>	r	..	..	<i>Paracalanus aculeatus</i>.....	..	..	2
<i>speciosus</i>	a	a	a	<i>parvus</i>.....	..	c	c
<i>typicus</i>	3	..	..	<i>Phaenna spinifera</i>.....	..	..	3
<i>Euchaeta acuta</i>.....	..	2	..	<i>Pleuromamma robusta</i>.....	..	..	1
<i>marina</i>	f	c	a	<i>Pontellina plumata</i>.....	..	..	1
<i>Euchirella curticauda</i>.....	..	f	..	<i>Pseudocalanus minutus</i>	f	c	c
<i>Farranula carinata</i>	a	a	f	<i>Sapphirina metallina</i>.....	..	..	f
<i>gibbula</i>.....	..	f	..	<i>opalina</i>.....	..	2	1
<i>rostrata</i>	r	..	f	<i>salpae</i>.....	..	..	1
<i>Haloptilus longicornis</i>.....	..	..	a	<i>Scolecithrix danae</i>.....	..	f	f
<i>plumosus</i>.....	..	..	a	<i>Undinula darwinii</i>.....	..	c	c
<i>Heterorhabdus papilliger</i>.....	..	..	2	<i>vulgaris</i>.....	..	c	..
<i>Labidocera detruncata</i>	c	..	..		

The temperature was high at the surface and fell 3° in the 100 meters; the salinity and hydrogen-ion concentration changed but little. Twenty-one species were found at the surface, 42 in the 50-meter tow, and 57 in the 100-meter tow. Thirty-five species (50 per cent) were each confined to a

single depth and 13 appeared at all three depths. The three tows were of practically the same length, but the volume of the 100-meter tow was 50 per cent larger than that of either of the others. *Candacia*, *Corycaeus*, *Farranula*, *Oithona*, and *Oncaea* were each found at all three depths.

STATION 150

October 23, 1929; 16° 15' N, 137° 06' W; bottom depth, 4553 m; 69 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	25.6	22.8	19.5	Density (σ_{tP})	22.9	24.0	25.0
Salinity, o/oo	34.6	34.7	34.6	Hydrogen-ion conc. (pH)	8.39	8.36	8.32
Volume of tow, cm ³	32	32	48	Length of tow, miles	3.1	3.2	3.1

<i>Acartia danae</i>.....	..	f	a	<i>Haloptilus spiniceps</i>.....	..	1	2
<i>negligens</i>.....	..	..	c	<i>Heterorhabdus papilliger</i>.....	..	r	r
<i>Acrocalanus gibber</i>	r	..	..	<i>spinifrons</i>.....	..	..	1
<i>gracilis</i>	c	c	c	<i>Labidocera detruncata</i>	f	..	..
<i>monachus</i>.....	..	..	1	<i>Lubbockia aculeata</i>.....	..	..	1
<i>Aetideus armatus</i>.....	..	..	2	<i>squillimana</i>.....	..	f	r
<i>Calanus minor</i>.....	..	..	c	<i>Lucicutia clausii</i>.....	..	c	c
<i>Calocalanus pavo</i>	r	c	c	<i>flavicornis</i>.....	..	c	a
<i>Candacia bispinosa</i>.....	..	f	c	<i>Macrosetella gracilis</i>.....	..	..	r
<i>simplex</i>	r	a	a	<i>oculata</i>.....	..	..	1
<i>Canthocalanus pauper</i>.....	..	2	..	<i>Mecynocera clausi</i>.....	..	c	c
<i>Centropages calaninus</i>.....	..	c	a	<i>Megacalanus longicornis</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>	r	a	..	<i>Microcalanus pygmaeus</i>.....	..	r	..
<i>furcatus</i>.....	..	c	f	<i>Microsetella rosea</i>	r	..	c
<i>Clytemnestra rostrata</i>.....	..	..	r	<i>Oithona plumifera</i>.....	..	f	..
<i>scutellata</i>.....	..	..	f	<i>similis</i>.....	..	c	c
<i>Copilia denticulata</i>	r	1	r	<i>spinirostris</i>.....	..	f	f
<i>quadrata</i>.....	..	2	r	<i>Oncaea curta</i>.....	..	r	..
<i>vitrea</i>.....	..	..	1	<i>minuta</i>	r	..	f
<i>Corycaeus agilis</i>	r	..	..	<i>venusta</i>.....	..	a	a
<i>crassiusculus</i>	a	r	..	<i>Onchocalanus nudipes, n. sp.</i>.....	..	..	f
<i>limbatus</i>	r	..	..	<i>Pachos punctatum</i>.....	..	..	4
<i>ovalis</i>	f	..	..	<i>tuberosum</i>.....	..	..	1
<i>pacificus</i>.....	..	..	1	<i>Paracalanus aculeatus</i>.....	..	f	1
<i>robustus</i>.....	..	3	..	<i>parvus</i>.....	..	c	c
<i>speciosus</i>.....	..	a	a	<i>pygmaeus</i>.....	..	c	c
<i>Eucalanus attenuatus</i>.....	..	..	2	<i>Pseudocalanus minutus</i>.....	..	..	f
<i>Euchaeta acuta</i>.....	..	..	r	<i>Sapphirina auronitens</i>	r	..	r
<i>marina</i>	c	c	c	<i>metallina</i>.....	..	2	r
<i>Euchirella brevis</i>.....	..	1	..	<i>nigromaculata</i>.....	..	..	r
<i>curticauda</i>	r	r	2	<i>Scolecithrix danae</i>.....	..	2	..
<i>Farranula carinata</i>	a	f	a	<i>Undinula caroli</i>.....	..	1	..
<i>gibbula</i>	f	..	..	<i>darwinii</i>.....	..	f	f
<i>rostrata</i>.....	..	..	r	<i>vulgaris</i>.....	..	c	..
<i>Haloptilus longicornis</i>.....	..	f	a				

The temperature was high at the surface and fell 6° in the 100 meters; the salinity and hydrogen-ion concentration changed but little. Eighteen species were captured at the surface, 39 in the 50-meter tow, and 52 in the 100-meter tow. Thirty-seven species (54 per cent) were each confined to a

single depth and 7 were present at all three depths. Again the three tows were of practically the same length, but the volume of the 100-meter tow was 50 per cent larger than that of either of the others. *Corycaeus*, *Farranula*, and *Oncaea* appeared in all tows; *Oithona* was absent from the surface.

STATION 151

October 25, 1929; 12° 40' N, 137° 32' W; bottom depth, 4918 m; 72 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	25.9	18.2	12.5	Density (σ_t)	22.3	25.0	26.6
Salinity, o/oo	34.0	34.4	34.6	Hydrogen-ion conc. (pH)	.....	.....	.....
Volume of tow, cm ³	64	80	32	Length of tow, miles	1.1	0.8	0.9

<i>Acrocalanus gibber</i>	a	..	..	<i>Labidocera detruncata</i>	a	..	1
<i>gracilis</i>	a	..	c	<i>Lubbockia aculeata</i>.....	..	..	2
<i>longicornis</i>	c	f	..	<i>squillimana</i>.....	..	r	..
<i>Aetideus armatus</i>.....	..	r	r	<i>Lucicutia clausii</i>.....	..	c	f
<i>Calanus minor</i>.....	..	c	..	<i>flavicornis</i>.....	..	c	c
<i>Calocalanus pavo</i>	r	c	f	<i>longicornis</i>.....	..	1	1
<i>Candacia simplex</i>.....	..	a	1	<i>Macrosetella gracilis</i>	f	c	a
<i>Canthocalanus pauper</i>	f	f	f	<i>oculata</i>.....	..	1	..
<i>Carnegiella gracilis</i> , n. gen. and n. sp.	..	..	1 ♀	<i>Mecynocera clausi</i>.....	..	f	f
<i>Centropages calaninus</i>	a	..	..	<i>Metridia brevicauda</i>.....	..	1	..
<i>elongatus</i>.....	..	..	r	<i>Microcalanus pusillus</i>.....	..	f	..
<i>violaceus</i>.....	..	f	r	<i>pygmaeus</i>	f	..	c
<i>Clausocalanus arcuicornis</i>	a	a	a	<i>Microsetella norvegica</i>.....	..	1	..
<i>furcatus</i>	a	c	..	<i>rosea</i>.....	..	c	c
<i>Clytemnestra rostrata</i>.....	..	r	..	<i>Neocalanus tenuicornis</i>.....	..	f	f
<i>scutellata</i>.....	..	r	..	<i>Oithona plumifera</i>.....	..	f	c
<i>Copilia denticulata</i>	r	r	..	<i>similis</i>.....	..	c	..
<i>quadrata</i>.....	..	r	2	<i>spinirostris</i>.....	..	f	f
<i>Corycaeus crassiusculus</i>	f	f	..	<i>Oithonina nana</i>.....	..	..	f
<i>flaccus</i>	2	..	..	<i>Oncaea media</i>	f	..	..
<i>pumilus</i>.....	..	..	r	<i>minuta</i>.....	..	c	a
<i>speciosus</i>	a	a	a	<i>notopa</i>.....	..	..	r
<i>typicus</i>.....	..	..	3	<i>venusta</i>.....	..	a	a
<i>Eucalanus attenuatus</i>.....	..	r	f	<i>Paracalanus aculeatus</i>	r	f	r
<i>elongatus</i>.....	..	r	f	<i>parvus</i>	c	c	a
<i>monachus</i>.....	..	f	r	<i>pygmaeus</i>	c	f	c
<i>mucronatus</i>.....	..	1	..	<i>Phaenna spinifera</i>.....	..	..	2
<i>Euchaeta acuta</i>.....	..	1	..	<i>Pleuromamma robusta</i>.....	..	r	r
<i>marina</i>	f	c	f	<i>Pontella tenuiremis</i>	5	..	..
<i>Euchirella brevis</i>.....	..	r	..	<i>Pontellina plumata</i>	r	..	..
<i>Farranula carinata</i>	a	a	a	<i>Pseudocalanus minutus</i>	c	..	a
<i>gibbula</i>	f	..	..	<i>Sapphirina angusta</i>	1	r	..
<i>rostrata</i>	f	..	..	<i>auronitens</i>	c	r	r
<i>Haloptilus longicornis</i>.....	..	r	f	<i>metallina</i>.....	..	..	1
<i>Heterorhabdus papilliger</i>.....	..	r	..	<i>nigromaculata</i>	c	f	r
<i>spinifrons</i>.....	..	r	..	<i>Undinula vulgaris</i>	c	c	f

The temperature was high at the surface and fell 13° in 100 meters; the density increased slightly. Thirty species were taken at the surface, 51 in the 50-meter tow, and 45 in the 100-meter tow. Thirty-one species (43 per cent) were

each confined to a single depth and 12 were found at all three depths. The 50-meter tow was shortest but yielded the largest volume. *Corycaeus*, *Farranula*, and *Oncaea* appeared in all three tows, but *Oithona* was absent from the surface.

STATION 152

October 27, 1929; 10° 05' N, 139° 44' W; bottom depth, 4830 m; 82 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.4	14.1	11.3	Density (σ_t)	21.6	26.0	26.9
Salinity, ‰	33.6	34.5	34.7	Hydrogen-ion conc. (pH)	8.35	7.87	7.76
Volume of tow, cm ³	32	32	80	Length of tow, miles	0.1	0.1	0.1

<i>Acartia danae</i>.....	..	r	c	<i>Haloptilus longicornis</i>.....	..	..	f
<i>negligens</i>	r	..	..	<i>plumosus</i>.....	..	..	r
<i>Acrocalanus gibber</i>.....	..	..	r	<i>Heterorhabdus papilliger</i>.....	..	..	1
<i>gracilis</i>	a	..	c	<i>spinifrons</i>.....	..	r	f
<i>longicornis</i>	f	..	..	<i>Labidocera detruncata</i>	f	..	..
<i>monachus</i>.....	..	f	..	<i>Lucicutia clausii</i>.....	..	..	f
<i>Actideus armatus</i>.....	..	r	r	<i>flavicornis</i>.....	..	c	r
<i>Calanus propinquus</i>.....	..	f	..	<i>longicornis</i>.....	..	..	r
<i>Calocalanus pavo</i>.....	..	c	f	<i>Macrosetella gracilis</i>.....	..	a	f
<i>plumulosus</i>.....	..	..	r	<i>Mecynocera clausi</i>.....	..	r	r
<i>styliremis</i>.....	..	r	..	<i>Microcalanus pygmaeus</i>.....	..	r	..
<i>Candacia simplex</i>.....	..	f	..	<i>Microsetella rosea</i>	f	c	a
<i>Canthocalanus pauper</i>.....	..	f	r	<i>Miracia efferata</i>.....	..	r	..
<i>Centropages calaninus</i>	c	r	r	<i>Neocalanus gracilis</i>.....	..	..	c
<i>elongatus</i>.....	..	r	r	<i>tenuicornis</i>	f	f	c
<i>furcatus</i>	r	..	..	<i>Oithona plumifera</i>.....	..	r	c
<i>Clausocalanus arcuicornis</i>.....	..	a	c	<i>similis</i>.....	..	a	a
<i>furcatus</i>.....	..	..	f	<i>spinirostris</i>.....	..	a	..
<i>Clytemnestra rostrata</i>.....	..	..	3	<i>Oithonina nana</i>.....	..	c	..
<i>scutellata</i>.....	..	..	r	<i>Oncaea media</i>	f	..	..
<i>Copilia denticulata</i>.....	..	..	r	<i>minuta</i>.....	..	a	c
<i>vitrea</i>.....	..	r	..	<i>notopa</i>.....	..	r	..
<i>Corycaeus anglicus</i>	r	..	..	<i>venusta</i>	a	a	a
<i>crassiusculus</i>	r	..	r	<i>Paracalanus aculeatus</i>.....	..	r	..
<i>dubius</i>	2	..	..	<i>parvus</i>.....	..	..	c
<i>lautus</i>.....	..	..	3	<i>Pleuromamma abdominalis</i>.....	..	..	f
<i>longistylis</i>.....	..	..	1	<i>robusta</i>.....	..	..	r
<i>pacificus</i>.....	..	2	..	<i>Pontella securifer</i>	1	..	..
<i>speciosus</i>	c	a	a	<i>Pseudocalanus minutus</i>.....	..	c	..
<i>typicus</i>	r	..	4	<i>Rhincalanus cornutus</i>.....	..	..	r
<i>Danodes plumata</i> , n. gen. and n. sp.	..	1 ♀	..	<i>nasutus</i>.....	..	..	r
<i>Eucalanus attenuatus</i>.....	..	f	f	<i>Sapphirina metallina</i>.....	..	2	..
<i>elongatus</i>.....	..	f	r	<i>nigromaculata</i>	1	..	r
<i>monachus</i>.....	..	..	f	<i>Scolecithricella abyssalis</i>.....	..	..	f
<i>Euchaeta marina</i>.....	..	c	f	<i>marginata</i>.....	..	..	r
<i>Euchirella pulchra</i>.....	..	..	r	<i>Scolecithrix danae</i>.....	..	..	c
<i>Farranula carinata</i>	a	..	c	<i>Spinocalanus magnus</i>.....	..	..	r
<i>gibbula</i>	r	..	..	<i>Temoropia mayumbaensis</i>.....	..	..	r
<i>rostrata</i>	r	..	r	<i>Undinula caroli</i>.....	..	f	..
<i>Gaetanus miles</i>.....	..	..	f	<i>darwinii</i>.....	..	f	c
<i>Gaidius tenuispinus</i>.....	..	..	1	<i>vulgaris</i>	a	..	..

The temperature was high at the surface and fell 16° in the 100 meters; the salinity increased and the hydrogen-ion concentration decreased somewhat. Twenty-one species were taken at the surface, 38 in the 50-meter tow, and 56 in the 100-meter tow. Fifty-four species (66 per cent) were each confined to a single depth and 5 were present at all three depths. The three tows were of exactly the same

length, but the volume of the 100-meter tow was two and a half times as large as that of either of the others. *Corycaeus* and *Oncaea* were present in each of the tows, but neither did *Farranula* appear in the 50-meter tow nor *Oithona* in the surface tow. The 100-meter tow contained *Temoropia mayumbaensis*, which was found also at station 35 in the eastern Pacific.

STATION 153

October 29, 1929; 7° 45' N, 141° 24' W; bottom depth, 5003 m; 66 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	28.0	28.0	20.5	Density (σ_{tp})	21.7	22.1	24.8
Salinity, o/oo	34.2	34.4	34.7	Hydrogen-ion conc. (pH)	8.47	8.39	8.28
Volume of tow, cm ³	32	32	64	Length of tow, miles	1.6	1.7	1.8

<i>Acartia danae</i>	r	..	..	<i>Haloptilus longicornis</i>.....	..	..	c
<i>longiremis</i>.....	..	f	f	<i>plumosus</i>.....	..	..	r
<i>Acrocalanus gracilis</i>	a	..	..	<i>spiniceps</i>.....	..	..	r
<i>Aetideus armatus</i>.....	..	..	r	<i>Heteramella dubia</i>.....	..	..	r
<i>Calanus helgolandicus</i>.....	..	..	f	<i>Heterorhabdus spinifrons</i>.....	..	..	r
<i>minor</i>.....	..	c	f	<i>Labidocera detruncata</i>	f	..	..
<i>Calocalanus pavo</i>	r	r	r	<i>Lucicutia flavicornis</i>.....	..	..	f
<i>stylemris</i>	1	..	..	<i>Mecynocera clausi</i>.....	..	r	r
<i>Candacia bispinosa</i>.....	..	..	f	<i>Microsetella norvegica</i>	f	a	c
<i>simplex</i>.....	..	a	a	<i>rosea</i>.....	..	..	f
<i>Canthocalanus pauper</i>	r	f	..	<i>Neocalanus gracilis</i>.....	..	a	a
<i>Centropages calaninus</i>	c	r	..	<i>tenuicornis</i>.....	..	c	c
<i>elongatus</i>	r	..	..	<i>Oithona setiger</i>.....	..	..	r
<i>furcatus</i>	r	r	r	<i>similis</i>.....	..	c	a
<i>violaceus</i>.....	..	..	r	<i>spinirostris</i>.....	..	..	f
<i>Clausocalanus arcuicornis</i>.....	..	a	a	<i>Oithonina nana</i>.....	..	f	f
<i>furcatus</i>.....	..	..	r	<i>Oncaea curta</i>.....	..	r	..
<i>Copilia denticulata</i>.....	..	..	r	<i>minuta</i>.....	..	a	c
<i>Corycaeus crassiusculus</i>	r	..	f	<i>tenella</i>	3	..	..
<i>flaccus</i>.....	..	..	2	<i>venusta</i>	a	a	a
<i>lautus</i>.....	..	3	..	<i>Paracalanus parvus</i>	f	f	f
<i>limbatus</i>	r	..	..	<i>Phaenna spinifera</i>.....	..	..	f
<i>pumilus</i>.....	..	..	4	<i>Pontellina plumata</i>	r	r	..
<i>speciosus</i>	c	a	a	<i>Pseudocalanus minutus</i>.....	..	..	f
<i>Eucalanus attenuatus</i>.....	..	r	f	<i>Rhincalanus nasutus</i>.....	..	..	r
<i>elongatus</i>.....	..	r	r	<i>Sapphirina auronitens</i>	1	..	..
<i>Euchaeta marina</i>.....	..	a	a	<i>nigromaculata</i>.....	..	r	r
<i>Euchirella brevis</i>.....	..	r	r	<i>Scolecithricella abyssalis</i>.....	..	..	f
<i>Farranula carinata</i>	a	a	c	<i>auropecten</i>.....	..	..	r
<i>curta</i>	f	..	..	<i>marginata</i>.....	..	f	f
<i>gibbula</i>.....	..	r	..	<i>Scolecithrix danae</i>.....	..	f	f
<i>rostrata</i>.....	..	r	f	<i>Undinula caroli</i>.....	..	..	r
<i>Haloptilus acutifrons</i>.....	..	..	r	<i>darwinii</i>.....	..	a	a

The temperature was high at the surface, remained the same at 50 meters, and dropped 7.5 at 100 meters; the salinity increased and the hydrogen-ion concentration decreased slightly. Twenty species were taken at the surface, 31 in the 50-meter tow, and 51 in the 100-meter tow. Thirty-seven species (56 per cent) were each confined to a single depth

and 7 were present at all three depths. The 100-meter tow was slightly longer than the others and its volume was twice as large. This tow also contained one of the two records for *Heteramella dubia*. *Corycaeus*, *Farranula*, and *Oncaea* were present in each of the tows, but *Candacia* and *Oithona* did not appear at the surface.

STATION 154

October 31, 1929; 6° 42' N, 143° 22' W; bottom depth, 5149 m; 64 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	28.3	28.2	25.3	Density (σ_{tP})	21.6	21.9	23.5
Salinity, ‰	34.1	34.1	34.8	Hydrogen-ion conc. (pH)	8.39	8.40	7.93
Volume of tow, cm ³	32	32	96	Length of tow, miles	0.1	0.1	0.1

<i>Acartia danae</i>.....	..	r	..	<i>Haloptilus longicornis</i>.....	..	..	c
<i>negligens</i>.....	..	..	r	<i>plumosus</i>.....	..	..	1
<i>Acrocalanus gibber</i>.....	..	r	f	<i>Heterorhabdus spinifrons</i>.....	..	..	f
<i>gracilis</i>.....	..	f	f	<i>Labidocera detruncata</i>	r	..	..
<i>monachus</i>.....	..	f	..	<i>Lucicutia clausii</i>.....	..	..	c
<i>Calocalanus pavo</i>.....	..	r	f	<i>flavicornis</i>.....	..	..	f
<i>styliremis</i>.....	..	..	r	<i>Macrosetella gracilis</i>	r	..	..
<i>Candacia norvegica</i>.....	..	r	..	<i>Mecynocera clausi</i>.....	..	1	r
<i>simplex</i>	r	a	a	<i>Megacalanus longicornis</i>.....	..	..	c
<i>Canthocalanus pauper</i>.....	..	f	..	<i>Microsetella norvegica</i>	r	r	..
<i>Centropages calaninus</i>.....	..	r	..	<i>rosea</i>	r	c	a
<i>elongatus</i>.....	..	r	r	<i>Neocalanus gracilis</i>.....	..	..	c
<i>Clausocalanus arcuicornis</i>	f	a	a	<i>robustior</i>.....	..	..	f
<i>furcatus</i>.....	..	c	c	<i>tenuicornis</i>.....	..	a	c
<i>Clytemnestra rostrata</i>.....	..	r	r	<i>Oithona plumifera</i>.....	..	f	c
<i>Copilia denticulata</i>.....	..	r	..	<i>similis</i>	r	..	a
<i>Corycaeus anglicus</i>.....	..	..	r	<i>spinirostris</i>.....	..	..	r
<i>crassiusculus</i>	a	c	..	<i>Oithonina nana</i>.....	..	..	f
<i>furcifer</i>.....	..	3	..	<i>Oncaea media</i>	f	..	..
<i>speciosus</i>	f	a	a	<i>minuta</i>.....	..	a	c
<i>typicus</i>	r	..	..	<i>notopa</i>.....	..	..	r
<i>Eucalanus attenuatus</i>.....	..	..	f	<i>subtilis</i>.....	..	..	r
<i>elongatus</i>.....	..	r	..	<i>venusta</i>	a	a	a
<i>Euchaeta acuta</i>.....	..	..	f	<i>Paracalanus aculeatus</i>.....	..	r	..
<i>marina</i>.....	..	a	a	<i>parvus</i>.....	..	c	c
<i>Euchirella brevis</i>.....	..	..	f	<i>Pontella tenuiremis</i>	r	..	..
<i>curticauda</i>.....	..	f	r	<i>Pontellina plumata</i>.....	..	..	r
<i>pulchra</i>.....	..	..	3	<i>Pseudocalanus minutus</i>.....	..	c	c
<i>Farranula carinata</i>	a	c	c	<i>Sapphirina nigromaculata</i>	r	r	r
<i>curta</i>	f	..	..	<i>Scolecithrix danae</i>.....	..	..	c
<i>gibbula</i>.....	..	..	f	<i>Undinula caroli</i>.....	..	..	r
<i>rostrata</i>.....	..	r	r	<i>darwinii</i>	r	a	a

The temperature was high at the surface and dropped 3° in the 100 meters; the salinity increased and the hydrogen-ion concentration diminished slightly. Seventeen species were taken at the surface, 35 in the 50-meter tow, and 47 in the 100-meter tow. Thirty-seven species (58 per cent)

were each confined to a single depth and 8 were present at all three depths. The five genera *Candacia*, *Corycaeus*, *Farranula*, *Oithona*, and *Oncaea* were each present in all three tows, but *Oncaea* was particularly abundant in the 100-meter tow.

STATION 155

November 2, 1929; 4° 51' N, 146° 46' W; bottom depth, 5304 m; 74 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.7	27.7	27.2	Density (σ_{tP})	22.4	22.6	23.1
Salinity, ‰	34.9	34.9	35.0	Hydrogen-ion conc. (pH)	8.29	8.30	8.30
Volume of tow, cm ³	64	96	128	Length of tow, miles	3.5	3.7	3.4

<i>Acartia danae</i>.....	..	a	a	<i>Farranula curta</i>	f	..	..
<i>longiremis</i>	f	..	..	<i>gibbula</i>.....	..	f	..
<i>negligens</i>	r	..	..	<i>rostrata</i>	c	..	f
<i>Acrocalanus gibber</i>.....	..	c	c	<i>Labidocera detruncata</i>	f	..	..
<i>gracilis</i>.....	..	..	c	<i>Lucicutia clausii</i>.....	..	f	..
<i>longicornis</i>.....	..	r	r	<i>flavicornis</i>.....	..	f	..
<i>monachus</i>.....	..	c	a	<i>Macrosetella gracilis</i>.....	..	2	f
<i>Calocalanus pavo</i>.....	..	a	c	<i>Mecynocera clausi</i>	r	r	r
<i>styliremis</i>.....	..	r	c	<i>Megacalanus longicornis</i>.....	..	c	f
<i>Candacia bispinosa</i>	c	..	..	<i>Microcalanus pygmaeus</i>	r	f	r
<i>catula</i>.....	..	..	1 ♀	<i>Microsetella norvegica</i>	c	..	..
<i>norvegica</i>.....	..	f	..	<i>rosea</i>.....	..	a	a
<i>simplex</i>	f	a	a	<i>Miracia efferata</i>.....	..	..	r
<i>Canthocalanus pauper</i>	r	c	a	<i>Neocalanus gracilis</i>	c	c	a
<i>Centropages calaninus</i>	1	f	..	<i>robustior</i>.....	..	r	r
<i>elongatus</i>.....	..	..	r	<i>tenuicornis</i>	c	..	c
<i>violaceus</i>.....	..	r	..	<i>Oithona plumifera</i>.....	..	c	c
<i>Clausocalanus arcuicornis</i>	a	a	a	<i>similis</i>	a	..	a
<i>furcatus</i>.....	..	a	a	<i>Oithonina nana</i>.....	..	..	c
<i>Clytemnestra rostrata</i>.....	..	..	r	<i>Oncaea curta</i>	3	..	..
<i>scutellata</i>.....	..	..	1	<i>minuta</i>	a	a	c
<i>Copilia denticulata</i>	r	r	r	<i>notopa</i>.....	..	r	..
<i>quadrata</i>.....	..	1	r	<i>venusta</i>	a	a	a
<i>Corycaeus andrewsi</i>	r	..	..	<i>Paracalanus aculeatus</i>.....	..	a	a
<i>crassiusculus</i>	c	..	f	<i>parvus</i>	f	c	a
<i>flaccus</i>	2	..	..	<i>Pennella</i> sp., copepodid.....	..	..	1
<i>lautus</i>.....	..	4	..	<i>Pontella cristata</i>	r	..	..
<i>longistylis</i>.....	..	2	..	<i>Pontellina plumata</i>	f	r	r
<i>pacificus</i>.....	..	..	2	<i>Pseudocalanus minutus</i>.....	..	..	a
<i>speciosus</i>	a	f	a	<i>Rhincalanus nasutus</i>	r	..	..
<i>Eucalanus attenuatus</i>	r	c	..	<i>Sapphirina auronitens</i>	r	..	..
<i>elongatus</i>	r	c	c	<i>metallina</i>.....	..	..	f
<i>Euchaeta acuta</i>.....	..	c	f	<i>nigromaculata</i>	r	1	r
<i>marina</i>	a	a	a	<i>opalina</i>.....	..	..	1
<i>Euchirella brevis</i>.....	..	c	a	<i>Scolecithrix danae</i>.....	..	a	a
<i>curticauda</i>.....	..	c	c	<i>Undinula caroli</i>.....	..	r	f
<i>Farranula carinata</i>	a	c	a	<i>darwinii</i>.....	..	a	a

The temperature was high at the surface and fell only 0.5 in the 100 meters; the salinity and hydrogen-ion concentration also remained practically unchanged. Thirty-four species were captured at the surface, 46 in the 50-meter tow, and 52 in the 100-meter tow. Thirty-three species (43 per cent) were each confined to a single depth and 16 were present

at all three depths. *Candacia*, *Corycaeus*, *Farranula*, *Oithona*, and *Oncaea* were present in each of the tows and quite evenly distributed. The 100-meter tow contains the only records for *Candacia catula* and *Pennella* during the entire cruise. The latter was in the free-swimming copepodid stage and the species could not be determined.

STATION 156

November 4, 1929; 3° 01' N, 149° 46' W; bottom depth, 4953 m; 78 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.6	27.0	26.3	Density (σ_{tP})	22.5	23.0	23.4
Salinity, o/oo	35.0	35.0	35.0	Hydrogen-ion conc. (pH)	8.34	8.35	8.33
Volume of tow, cm ³	48	32	128	Length of tow, m	1.6	1.5	1.7
<i>Acartia danae</i>.....	..	c	a	<i>Farranula gibbula</i>.....	..	f	..
<i>longiremis</i>	r	..	..	<i>rostrata</i>	f	..	r
<i>Acrocalanus gibber</i>.....	..	..	f	<i>Heterorhabdus spinifrons</i>.....	..	r	..
<i>gracilis</i>.....	..	..	c	<i>Lucicutia clausii</i>.....	..	..	f
<i>monachus</i>.....	..	r	c	<i>flavicornis</i>.....	..	..	r
<i>Calocalanus pavo</i>	f	c	a	<i>Macrosetella gracilis</i>.....	..	r	..
<i>plumulosus</i>	r	f	..	<i>Mecynocera clausi</i>.....	..	r	r
<i>styliremis</i>.....	..	f	r	<i>Megacalanus longicornis</i>.....	..	r	a
<i>Candacia bispinosa</i>.....	..	..	r	<i>Microcalanus pygmaeus</i>	a	c	r
<i>norvegica</i>.....	..	..	f	<i>Microsetella norvegica</i>	f	..	..
<i>pachydactyla</i>.....	..	..	f	<i>rosea</i>.....	..	c	a
<i>simplex</i>.....	..	r	a	<i>Miracia efferata</i>.....	..	..	r
<i>Canthocalanus pauper</i>	c	f	..	<i>Neocalanus gracilis</i>.....	..	..	c
<i>Centropages calaninus</i>.....	..	..	r	<i>robustior</i>.....	..	..	r
<i>elongatus</i>.....	..	r	r	<i>tenuicornis</i>.....	..	c	c
<i>violaceus</i>	r	..	..	<i>Oithona plumifera</i>.....	..	f	c
<i>Clausocalanus arcuicornis</i>	f	a	a	<i>setiger</i>	2	..	..
<i>furcatus</i>.....	..	..	a	<i>similis</i>.....	..	a	a
<i>Clytemnestra rostrata</i>.....	..	..	r	<i>spinirostris</i>.....	..	..	f
<i>scutellata</i>.....	..	..	r	<i>Oithonina nana</i>.....	..	r	c
<i>Copilia denticulata</i>	r	..	r	<i>Oncaea curta</i>.....	..	r	..
<i>quadrata</i>.....	..	r	..	<i>media</i>.....	..	r	..
<i>vitrea</i>.....	..	..	r	<i>minuta</i>	a	c	c
<i>Corycaeus agilis</i>	r	..	..	<i>notopa</i>	3	..	..
<i>catus</i>.....	..	2	..	<i>venusta</i>	f	a	a
<i>crassiusculus</i>	f	a	..	<i>Paracalanus aculeatus</i>.....	..	c	c
<i>furcifer</i>.....	..	..	3	<i>parvus</i>.....	..	c	c
<i>limbatus</i>.....	..	..	r	<i>Pontella cristata</i>	r	..	..
<i>pumilus</i>.....	..	..	r	<i>Pontellina plumata</i>	r	..	r
<i>robustus</i>.....	..	2	..	<i>Pseudocalanus minutus</i>.....	..	c	c
<i>speciosus</i>	a	a	a	<i>Sapphirina auronitens</i>	r	r	..
<i>Dysgamus atlanticus</i>.....	..	..	1 ♂	<i>metallina</i>.....	..	1	1
<i>Eucalanus attenuatus</i>.....	..	r	a	<i>nigromaculata</i>	r	r	r
<i>elongatus</i>.....	..	..	a	<i>opalina</i>.....	..	..	r
<i>Euchaeta marina</i>.....	..	a	a	<i>Scolecithricella auropecten</i>.....	..	r	..
<i>Euchirella brevis</i>.....	..	c	c	<i>marginata</i>	f	r	..
<i>curticauda</i>.....	..	f	c	<i>Scolecithrix danae</i>.....	..	c	a
<i>Farranula carinata</i>	a	a	a	<i>Undinula caroli</i>.....	..	r	f
<i>curta</i>	r	..	..	<i>darwinii</i>.....	..	c	a

The temperature was high at the surface and fell 1° in the 100 meters; the salinity and hydrogen-ion concentration remained almost constant. Twenty-four species were taken at the surface, 45 in the 50-meter tow, and 56 in the 100-meter tow. Thirty-nine species (50 per cent) were each con-

finied to a single depth and 8 were present at all three depths. *Corycaeus*, *Farranula*, *Oithona*, and *Oncaea* were found in each tow, but *Candacia* only in the 100-meter tow, which also contained the only record for *Dysgamus atlanticus*, a parasitic form that sometimes leaves its host and swims about freely.

STATION 157

November 6, 1929; 1° 48' S, 152° 22' W; bottom depth, 4693 m; 71 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	27.0	27.0	26.8	Density (σ_{tP})	22.8	23.1	23.5
Salinity, o/oo	35.2	35.2	35.4	Hydrogen-ion conc. (pH)	8.27	8.32	8.30
Volume of tow, cm ³	32	80	64	Length of tow, miles	0.4	0.9	0.9

<i>Acartia danae</i>	c	a	..	<i>Haloptilus acutifrons</i>.....	..	..	2
<i>longiremis</i>.....	..	..	f	<i>longicornis</i>.....	..	..	r
<i>Acrocalanus gibber</i>	c	..	..	<i>Labidocera detruncata</i>	r	..	..
<i>gracilis</i>	c	..	..	<i>Macrosetella gracilis</i>.....	..	1	..
<i>monachus</i>	f	c	..	<i>oculata</i>.....	..	1	..
<i>Aegisthus spinulosus</i>	1	r	..	<i>Mecynocera clausi</i>.....	..	r	..
<i>Calanus minor</i>.....	..	..	c	<i>Megacalanus longicornis</i>.....	..	r	r
<i>propinquus</i>.....	..	c	..	<i>Microcalanus pygmaeus</i>	c	c	..
<i>Calocalanus pavo</i>	a	a	r	<i>Microsetella norvegica</i>.....	..	r	c
<i>styliremis</i>	r	r	..	<i>rosea</i>	a	a	..
<i>Candacia bispinosa</i>.....	..	r	..	<i>Miracia efferata</i>	c	r	..
<i>simplex</i>	r	a	c	<i>Neocalanus gracilis</i>.....	..	c	a
<i>Canthocalanus pauper</i>	f	c	..	<i>robustior</i>.....	..	1	..
<i>Centropages calaninus</i>	r	r	..	<i>tenuicornis</i>	c	a	c
<i>elongatus</i>	c	c	r	<i>Oithona plumifera</i>	f	f	..
<i>furcatus</i>	r	r	..	<i>robusta</i>.....	..	..	r
<i>Clausocalanus arcuicornis</i>	a	a	c	<i>setiger</i>.....	..	..	r
<i>Copilia denticulata</i>	f	r	..	<i>similis</i>	a	a	a
<i>quadrata</i>	f	r	..	<i>spirostris</i>	f	r	..
<i>Corycaeus clausi</i>	2	..	..	<i>Oithonina nana</i>	f	..	..
<i>crassiusculus</i>	f	c	c	<i>Oncaea media</i>.....	..	..	f
<i>dubius</i>.....	..	3	..	<i>minuta</i>	c	c	..
<i>furcifer</i>.....	..	..	3	<i>tenella</i>	r	..	..
<i>longistylis</i>.....	..	..	3	<i>venusta</i>	a	a	a
<i>ovalis</i>	3	1	..	<i>Paracalanus aculeatus</i>.....	..	c	..
<i>speciosus</i>	a	a	a	<i>parvus</i>	c	a	c
<i>typicus</i>.....	..	..	r	<i>Pontellina plumata</i>	r	r	r
<i>Eucalanus attenuatus</i>	c	c	r	<i>Pseudocalanus minutus</i>.....	..	a	c
<i>elongatus</i>	f	c	..	<i>Rhincalanus cornutus</i>.....	..	..	r
<i>Euchaeta marina</i>.....	..	c	c	<i>nasutus</i>.....	..	..	r
<i>Euchirella brevis</i>.....	..	c	f	<i>Sapphirina auronitens</i>	r	..	r
<i>curticauda</i>.....	..	c	..	<i>nigromaculata</i>.....	..	r	..
<i>Farranula carinata</i>	a	a	c	<i>Scolecithrix danae</i>.....	..	a	f
<i>curta</i>.....	..	..	f	<i>Undinula caroli</i>.....	..	r	..
<i>gibbula</i>	f	..	..	<i>darwinii</i>.....	..	a	f
<i>rostrata</i>.....	..	a	c				

The temperature was high at the surface and fell only 0.2 in the 100 meters; the salinity and hydrogen-ion concentration also remained almost constant. Thirty-eight species were captured at the surface, 50 in the 50-meter tow, and 36 in the 100-meter tow, an exceptionally uniform vertical distribution. Thirty-one species (44 per cent) were

each confined to a single depth and 13 were present at all three depths. *Candacia*, *Corycaeus*, *Farranula*, *Oithona*, and *Oncaea* were all present in each tow. The two deeper tows were more than twice the length of the surface tow and their volume was proportionally larger. The 50-meter tow contained a large number of development stages.

STATION 158

November 8, 1929; 6° 33' S, 154° 58' W; bottom depth, 4065 m; 54 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	28.1	28.1	27.6	Density (σ_{tP})	22.7	23.0	23.6
Salinity, o/oo	35.5	35.5	35.8	Hydrogen-ion conc. (pH)	8.34	8.39	8.39
Volume of tow, cm ³	32	80	32	Length of tow, miles	0.7	2.2	2.2

<i>Acartia clausii</i>.....	..	..	r	<i>Farranula gibbula</i>.....	..	..	r
<i>danae</i>	a	a	..	<i>rostrata</i>	r	f	f
<i>longiremis</i>.....	..	..	c	<i>Labidocera detruncata</i>	r	..	..
<i>Anomalocera patersonii</i>	r	..	..	<i>Lucicutia flavicornis</i>.....	..	..	c
<i>Calanus helgolandicus</i>.....	..	..	f	<i>Mecynocera clausi</i>	r	r	..
<i>Calocalanus pavo</i>	r	f	..	<i>Microcalanus pygmaeus</i>	r	c	..
<i>styliremis</i>.....	..	r	..	<i>Microsetella norvegica</i>.....	..	l	a
<i>Candacia aethiopica</i>.....	..	..	r	<i>rosea</i>	r	a	..
<i>bispinosa</i>.....	..	r	c	<i>Neocalanus gracilis</i>.....	..	c	r
<i>simplex</i>.....	..	a	..	<i>tenuicornis</i>.....	..	c	r
<i>truncata</i>.....	..	..	c	<i>Oithona plumifera</i>	r	f	r
<i>Canthocalanus pauper</i>.....	..	c	..	<i>similis</i>.....	..	..	a
<i>Centropages calaninus</i>.....	..	c	r	<i>spinirostris</i>	r	f	..
<i>elongatus</i>.....	..	f	..	<i>Oithonina nana</i>	r	f	..
<i>furcatus</i>.....	..	r	r	<i>Oncaea minuta</i>.....	..	a	c
<i>Clausocalanus arcuicornis</i>	r	a	a	<i>notopa</i>	r	..	..
<i>Corycaeus anglicus</i>	r	..	..	<i>venusta</i>	c	a	a
<i>crassiusculus</i>	c	f	f	<i>Paracalanus parvus</i>	c	a	..
<i>pumilus</i>.....	..	4	..	<i>Pontellina plumata</i>.....	..	f	..
<i>speciosus</i>	a	a	a	<i>Pseudocalanus minutus</i>.....	..	a	..
<i>typicus</i>.....	..	..	r	<i>Rhincalanus nasutus</i>.....	..	r	..
<i>Eucalanus attenuatus</i>.....	..	r	c	<i>Sapphirina angusta</i>.....	..	..	r
<i>elongatus</i>.....	..	f	..	<i>auronitens</i>	r	..	..
<i>Euchaeta marina</i>.....	..	a	a	<i>Scolecithricella marginata</i>.....	..	..	c
<i>Euchirella curticauda</i>.....	..	f	..	<i>spinacantha</i> , n. sp.....	..	r	..
<i>Farranula carinata</i>	a	a	a	<i>Scolecithrix danae</i>.....	..	c	c
<i>curta</i>	r	..	..	<i>Undinula darwinii</i>.....	..	a	f

The temperature was high at the surface and fell only 0.5 in the 100 meters; the salinity and hydrogen-ion concentration also changed but little. Twenty-one species were captured at the surface, 37 in the 50-meter tow, and 29 in the 100-meter tow. Twenty-eight species (52 per cent) were each confined to a single depth and 7 were present at all

three depths. *Corycaeus*, *Farranula*, *Oithona*, and *Oncaea* were found in each of the tows, and especially at the surface, but *Candacia* did not appear in the surface tow. This latter tow contains one of the few records for *Anomalocera patersonii* during the cruise. The 50-meter tow contains the first record of the new species *Scolecithricella spinacantha* (cf. sta. 159).

STATION 159

November 11, 1929; 9° 24' S, 159° 01' W; bottom depth, 5545 m; 76 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	28.6	28.5	28.0	Density (σ_t)	22.7	23.0	23.4
Salinity, ‰	35.7	35.7	35.7	Hydrogen-ion conc. (pH)	8.37	8.38	8.37
Volume of tow, cm ³	32	48	64	Length of tow, miles	0.8	1.1	1.1

<i>Acartia clausii</i>	f	..	..	<i>Farranula curta</i>.....	..	r	..
<i>danae</i>.....	..	f	..	<i>gibbula</i>	r	..	..
<i>longiremis</i>	c	..	f	<i>rostrata</i>.....	..	f	f
<i>negligens</i>.....	..	r	..	<i>Haloptilus longicornis</i>.....	..	..	c
<i>Aetideus armatus</i>.....	..	..	r	<i>spiniceps</i>.....	..	..	r
<i>Amalothrix propinqua</i>.....	..	..	r	<i>Heterorhabdus spinifrons</i>.....	..	..	f
<i>Calanus minor</i>	f	..	c	<i>Labidocera detruncata</i>	a	..	f
<i>Calocalanus pavo</i>	r	f	r	<i>Lucicutia flavicornis</i>.....	..	a	c
<i>plumulosus</i>.....	..	..	r	<i>Macrosetella gracilis</i>.....	..	r	..
<i>styliremis</i>.....	..	r	r	<i>Mecynocera clausi</i>.....	..	r	r
<i>Candacia aethiopica</i>.....	..	..	f	<i>Microcalanus pygmaeus</i>.....	..	a	a
<i>bispinosa</i>	a	f	c	<i>Microsetella norvegica</i>	c	..	c
<i>norvegica</i>.....	..	r	..	<i>rosea</i>.....	..	a	a
<i>simplex</i>.....	..	a	c	<i>Neocalanus gracilis</i>.....	..	c	c
<i>Canthocalanus pauper</i>.....	..	a	f	<i>tenuicornis</i>.....	..	f	c
<i>Centropages calaninus</i>.....	..	r	r	<i>Oithona plumifera</i>.....	..	f	f
<i>elongatus</i>.....	..	r	r	<i>similis</i>	a	a	a
<i>furcatus</i>	f	f	..	<i>spinirostris</i>.....	..	c	f
<i>Clausocalanus arcuicornis</i>	a	a	a	<i>Oithonina nana</i>.....	..	f	c
<i>furcatus</i>	a	..	..	<i>Oncaea media</i>.....	..	r	..
<i>Clytemnestra rostrata</i>.....	..	r	r	<i>minuta</i>.....	..	c	a
<i>scutellata</i>.....	..	r	r	<i>notopa</i>	r	..	..
<i>Corycaeus agilis</i>	3	..	..	<i>venusta</i>.....	..	a	..
<i>catus</i>.....	..	2	..	<i>Paracalanus parvus</i>.....	..	a	c
<i>crassiusculus</i>	f	c	f	<i>Pontella cristata</i>	r	..	..
<i>flaccus</i>.....	..	3	..	<i>Pontellina plumata</i>.....	..	f	..
<i>lautus</i>.....	..	..	4	<i>Pseudocalanus minutus</i>.....	..	a	c
<i>ovalis</i>	1	..	..	<i>Rhincalanus cornutus</i>.....	..	r	..
<i>pacificus</i>.....	..	..	1	<i>nasutus</i>.....	..	r	f
<i>robustus</i>	1	..	..	<i>Sapphirina angusta</i>	1	..	..
<i>speciosus</i>	c	a	a	<i>auronitens</i>	r	..	..
<i>Danodes plumata</i> , n. gen. and n. sp.	..	..	r ♀	<i>Scolecithricella abyssalis</i>.....	..	c	..
<i>Eucalanus attenuatus</i>	c	c	f	<i>bradyi</i>	1	..	..
<i>elongatus</i>.....	..	r	c	<i>marginata</i>.....	..	a	..
<i>Euchaeta marina</i>	f	a	a	<i>spinacantha</i> , n. sp. ....	..	f	..
<i>Euchirella brevis</i>.....	..	c	c	<i>Scolecithrix danae</i>	r	c	c
<i>curticauda</i>.....	..	f	r	<i>Undinula caroli</i>.....	..	r	..
<i>Farranula carinata</i>	a	a	a	<i>darwinii</i>.....	..	a	c

The temperature was high at the surface and fell only 0.6° in the 100 meters; the salinity and hydrogen-ion concentration remained practically unchanged. Twenty-six species were taken at the surface, 50 in the 50-meter tow, and 51 in the 100-meter tow. Thirty-five species (47 per cent) were each confined to a single depth and 9 were present at

all three depths. *Candacia*, *Corycaeus*, *Farranula*, *Oithona*, and *Oncaea* were present in all tows, but more abundant in the deeper tows. The 50-meter tow contained the new species *Scolecithricella spinacantha*, and is the second of two adjacent stations where it appeared. The deeper tows were a little longer than the surface tow and their volume was larger.

PENRRHYN ISLAND, LAGOON

November 10, 1929; 9° 02' S, 157° 59' W; 10 species

Acrocalanus gracilis.....	1	Oithona similis.....	3	Paracalanus parvus.....	a
Farranula carinata.....	r	Oncaea minuta.....	r	pygmaeus.....	c
rostrata.....	2	venusta.....	f	Undinula vulgaris.....	1
Mesocyclops leuckarti.....	a				

This was an anchorage tow, at the surface, between stations 159 and 160, and yielded 10 species, none of which are worthy of comment except *Mesocyclops leuckarti*. All the

other species in this list are typical pelagic forms, and here is an equally typical fresh-water form found abundantly in their midst. Volume of tow, 32 cm³.

STATION 160

November 13, 1929; 10° 54' S, 161° 53' W; bottom depth, 2614 m; 74 species

Depth of tow, m	0	50	100	Depth of tow, m	0	50	100
Temperature, °C	28.5	28.5	28.5	Density (σ_{tP})	22.6	22.9	23.2
Salinity, o/oo	35.5	35.6	35.6	Hydrogen-ion conc. (pH)	8.37	8.39	8.44
Volume of tow, cm ³	32	32	48	Length of tow, miles	0.6	0.6	0.7

Acartia danae.....	f	..	c	Farranula curta.....	r	..	..
longiremis.....	r	..	r	rostrata.....	c	..	r
Aetideus armatus.....	..	..	r	Haloptilus longicornis.....	..	..	a
Amallothrix propinqua.....	..	..	r	spiniceps.....	..	..	r
Calanus helgolandicus.....	..	f	..	Heterorhabdus spinifrons.....	..	..	r
Calocalanus pavo.....	c	r	f	Labidocera acutifrons.....	..	r	..
Candacia aethiopica.....	3	r	r	detruncata.....	c	..	..
bispinosa.....	r	..	f	Lubbockia squillimana.....	..	..	r
norvegica.....	f	r	r	Lucicutia clausii.....	..	..	r
simplex.....	f	..	a	flavicornis.....	..	..	a
truncata.....	..	c	..	Macrosetella gracilis.....	..	..	r
Canthocalanus pauper.....	r	..	c	Mecynocera clausi.....	a	r	r
Centropages calaninus.....	2	..	..	Microcalanus pygmaeus.....	f	..	c
elongatus.....	f	..	..	Microsetella norvegica.....	f	f	r
furcatus.....	..	r	r	rosea.....	f	..	a
Clausocalanus arcuicornis.....	c	a	a	Neocalanus gracilis.....	..	r	f
Clytemnestra rostrata.....	..	..	r	tenuicornis.....	..	f	c
Copilia denticulata.....	..	..	r	Oithona plumifera.....	..	f	f
quadrata.....	4	..	r	similis.....	c	c	a
Corycaeus anglicus.....	3	..	..	spinirostris.....	..	c	f
clausi.....	4	..	..	Oithonina nana.....	..	f	f
crassiusculus.....	f	f	f	Oncaea conifera.....	..	..	r
dubius.....	..	r	..	minuta.....	c	c	c
furcifer.....	..	..	3	notopa.....	..	..	c
giesbrechti.....	..	3	..	similis.....	..	r	..
limbatus.....	..	..	r	tenella.....	r	..	..
lubbockii.....	1	..	..	venusta.....	a	c	a
pumilus.....	..	..	r	Paracalanus parvus.....	a	f	c
speciosus.....	c	c	a	Pleuromamma gracilis.....	..	..	r
typicus.....	r	f	f	Pontellina plumata.....	3	r	..
Danodes plumata, n. gen. and n. sp.	..	..	1 ♀	Pseudocalanus minutus.....	..	..	c
Eucalanus attenuatus.....	..	r	f	Sapphirina auronitens.....	2	..	r
elongatus.....	..	..	r	nigromaculata.....	..	..	r
Euchaeta marina.....	c	a	a	Scolecithricella abyssalis.....	..	..	c
Euchirella brevis.....	r	r	r	Scolecithrix danae.....	..	a	f
curticauda.....	r	..	r	Undinula caroli.....	..	..	r
Farranula carinata.....	a	c	c	darwinii.....	c	c	c

The temperature was high at the surface and did not change at all in the 100 meters; the salinity and hydrogen-ion concentration also remained practically unchanged. Thirty-seven species were captured at the surface, 32 in the 50-meter tow, and 59 in the 100-meter tow. Thirty-seven species (50 per cent) were each confined to a single level and

17 were present at all three levels. *Candacia*, *Corycaeus*, *Farranula*, and *Oncaea* were all found in each of the tows, and 4 of the 5 species of *Candacia* appeared at the surface, an exceptional distribution. The 100-meter tow contained 1 specimen of the new genus and species *Danodes plumata*, also 1 rather rare species of *Scolecithricella* and 1 of *Amallothrix*.

DISCUSSION OF SPECIES

(Alphabetically Arranged)

Since this paper deals chiefly with the geographical and vertical distribution of the copepod species, they are here arranged for convenient reference in alphabetical order without reference to their systematic relationships. The number of new species is small considering the thousands of specimens examined, but is all that could be expected in tows made so near the surface of the ocean.

Attention has been concentrated particularly on discovering the reactions of a long list of known species of copepods to temperature, salinity, hydrogen-ion concentration, and light in their native habitat. A surprising amount of information along these lines may be extracted from the station records above, and this has been presented according to species in the discussion that follows.

[The bibliographic references to the original publication of each species given in this paper did not appear in the original manuscript submitted to the Institution. They have been assembled and verified by Miss Lucile McCain, of the Division of Marine Invertebrates, U. S. National Museum. In the case of species amplified by Dana and Giesbrecht in their larger monographs (in 1853-1855 and 1892 respectively), reference to these particular works is also made, as well as to the very brief original descriptions.—ED.]

Genus ACARTIA Dana, 1846

Acartia clausii Giesbrecht

[*Acartia clausii* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 2, p. 25, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 508, 522, pl. 30, figs. 2, 6, 9, 13-15, 17, 28, 36, 37; pl. 31, figs. 36, 37; pl. 42, fig. 32; pl. 43, figs. 3, 5, 14, 1892.]

Found at only four scattered stations in the central and northern Pacific, but more common in the northern Atlantic. It was taken in 7 nocturnal and 7 diurnal surface tows, 4 50-meter tows, and 5 100-meter tows. All the *Carnegie* specimens taken in northern latitudes were at the surface or in the 50-meter tows; those found in the tropics were in the two deeper tows. It is worthy of note that this species was not recorded in the *Challenger* or the *Siboga* expedition, nor from any Pacific station in Sars' (1925) "Bathypelagic copepods." It would seem, therefore, to be more or less indifferent or possibly somewhat positive to the weaker light of northern regions, but becomes negative to the strong light of the tropics.

Acartia danae Giesbrecht

[*Acartia danae* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 2, p. 26, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 508, 522, pl. 30, figs. 1, 23; pl. 43, fig. 8, 1892.]

Not obtained at any of the Atlantic localities, but widely distributed and often very abundant in the Pacific. With minor exceptions there are two notable gaps in its dispersion in the latter ocean, one from station 48 to 61 in the southeastern region and the other from station 116 to 131 in the region north of 40° parallel of latitude. It was present in 19 nocturnal and 46 diurnal surface tows, 77 50-meter tows, and 60 100-meter tows, and in the vertical tow from 1000 meters at station 64. This would indicate, as in the previous species, more or less indifference to ordinary light with a definite downward movement when the light becomes stronger. The species is readily recognized by the strong spines at the posterior corners of the fifth thoracic segment.

Acartia longiremis (Lilljeborg)

[*Dias longiremis* Lilljeborg, De crustaceis ex ordinibus tribus: Cladocera, Ostracoda et Copepoda, in Scania occurrence, p. 181, pl. 24, 1853.]

Present at nearly every locality in the Sargasso and Caribbean regions, but confined to a few stations in the Pacific, north of the Samoan Islands. It was found in 1 nocturnal and 10 diurnal surface tows, 11 50-meter tows, and 14 100-meter tows. So far as the present vertical distribution indicates, it is practically indifferent to light. Sars (1903, p. 149) stated that this species sometimes occurs in great numbers along the Norwegian coast, but no trace of such gregarious communities was found in the present plankton.

Acartia negligens Dana

[*Acartia negligens* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 26, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1121, 1853; pl. 79, fig. 3a-c, 1855.]

Not present in the Atlantic plankton; in the Pacific it was well distributed in the eastern and southeastern parts but everywhere else extremely straggling, with an appearance at one or two consecutive localities and long intermediate stretches of total absence from the plankton. It was taken in 16 nocturnal and 25 diurnal surface tows, 27 50-meter tows, and 27 100-meter tows; also in the vertical tow from 1000 meters, station 64. Such a vertical distribution indicates even more indifference to light than in any of the preceding species, and this conclusion is strengthened by the fact that the species was often found equally distributed in all three tows at the same time.

Genus ACROCALANUS Giesbrecht, 1888

This genus was not found in the Atlantic plankton obtained by the *Carnegie*, but the species *longicornis* has been reported from the North Atlantic. Four species of the genus were found quite abundantly in the Pacific, one or more occurring in every region, so that the genus cannot be desig-

nated as belonging to any particular zone. The species are all very small, with both fifth legs lacking in the female and the right one in the male.

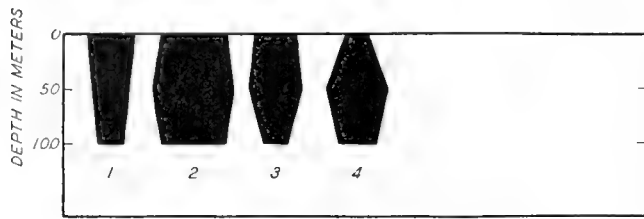


CHART 1. Daytime vertical distribution of species of *Acrocalanus*: (1) *gibber*, (2) *gracilis*, (3) *longicornis*, (4) *monachus*. The four species were well distributed at all three depths. Three of them were more abundant in the 50-meter tow than in either of the other tows, but the fourth was found at the surface not only more often but also in greater abundance.

Acrocalanus gibber Giesbrecht

[*Acrocalanus gibber* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 332, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 171, 175, pl. 6, fig. 32, 1892.]

Each species of the genus shows very prominent gaps in its distribution, those for the present species including stations 44 to 54, 59 to 63, 68 to 91, 117 to 131, all inclusive. It was found in 9 nocturnal and 29 diurnal surface tows, 25 50-meter tows, and 22 100-meter tows. It is thus apparently indifferent to light, and this conclusion is strengthened by the fact that it is found frequently at the surface, at any two of the depths, or even at all three. The surface records not only are more numerous than those from the other tows, but also indicate a larger number of specimens.

Acrocalanus gracilis Giesbrecht

[*Acrocalanus gracilis* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 332, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 171, 175, pl. 6, fig. 27, 1892.]

More widely distributed than the preceding species, but not found from stations 71 to 77 inclusive, with a few other gaps of one or two localities only. This species was present in 31 nocturnal and 75 diurnal surface tows, 78 50-meter tows, and 75 100-meter tows, and in the vertical tow from 1000 meters, station 64. In the daytime, therefore, the vertical distribution at the three depths was exceptionally even, but the abundance records in the surface tows were slightly higher than the others.

Acrocalanus longicornis Giesbrecht

[*Acrocalanus longicornis* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 332, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 171, 175, pl. 6, figs. 25, 33; pl. 10, figs. 34, 36, 39, 1892.]

The gaps in the distribution of this species extend from stations 42 to 51, 55 to 65, 67 to 87, and 114 to 134, inclusive. This species was taken in 1 nocturnal and 19 diurnal surface tows, 26 50-meter tows, and 13 100-meter tows. Here, then, the 50-meter tow definitely surpasses either of the others, and there is a marked contrast between the 1 nocturnal surface

tow and the 31 for the previous species. This species has been recorded from the Atlantic and Indian oceans and the Red Sea as well as from the Pacific, and its absence from the North Atlantic in the present plankton is noteworthy.

Acrocalanus monachus Giesbrecht

[*Acrocalanus monachus* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 333, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 171, 175, pl. 6, figs. 26, 31; pl. 10, fig. 38, 1892.]

From station 36 to 86 this species was present only in solitary localities; from 88 to 107 it was present at every station except two, and from 108 to 157 it was again found only at isolated stations, making it the least common of the four species. The forehead is very high, projects forward, and is acutely rounded at the anterior corner, which in the present material was nearly always white, facilitating the identification of the species. It was found in 2 nocturnal and 11 diurnal surface tows, 32 50-meter tows, and 17 100-meter tows. Here again a majority of the specimens manifested a definite preference for the 50-meter tow.

Genus *AEGISTHUS* Giesbrecht, 1891

Aegisthus spinulosus Farran

[*Aegisthus spinulosus* Farran, Ann. Rept. Fisheries, Ireland, 1902-03, pt. 2, app. 2, pp. 46, 47, pl. 12, figs. 8-14; pl. 13, figs. 1-4, 1905.]

Found only at 9 localities in the eastern Pacific and at 1 station north of the Samoan Islands. It was captured in 3 nocturnal and 3 diurnal surface tows, 2 50-meter tows, and 2 100-meter tows. These meager records do not warrant any general conclusion except the negative one that this species does not always migrate downward in the daytime.

Genus *AETIDEUS* Brady, 1883

Aetideus armatus (Boeck)

[*Pseudocalanus armatus* Boeck, Forhandl. Vidensk. Selsk. Christiania, vol. 14, p. 38, 1872.]

Well distributed in the Sargasso and Caribbean regions, but quite gregarious in the Pacific and limited to a few localities in each of four regions: the eastern tropical, north of the Samoan Islands, north of the Caroline Islands, and north of the Hawaiian Islands. It was taken in 1 nocturnal surface tow, 10 50-meter tows, and 41 100-meter tows, but was nowhere abundant, more than half the records being expressed in numerals. Thus it is definitely negative to light but comes to the surface sometimes during the night.

Genus *AMALLOPHORA* T. Scott, 1894

Amallophora typica T. Scott

(Figure 1)

[*Amallophora typica* T. Scott, Trans. Linn. Soc. London, ser. 2, Zool., vol. 6, pt. 1, p. 54, pl. 3, figs. 30-46; pl. 4, figs. 1-4, 1894.]

Two females were obtained in the vertical haul from a depth of 1000 meters at station 64, and these constitute the

only record for the entire cruise. All the specimens thus far obtained have been deep-water captures and probably this copepod does not get into the upper 100 meters during the daytime. The species is distinguished by a very large sense organ at the tip of the second maxilla and by the structure of the fifth legs.

Genus **AMALLOTHRIX** G. O. Sars, 1925



CHART 2. Daytime vertical distribution of certain species of *Amallothrix*: (1) *arcuata*, (2) *obtusifrons*, (3) *propinqua*.

Amallothrix arcuata (G. O. Sars)

(Figures 5, 131)

[*Scolecithricella arcuata* G. O. Sars, Bull. Inst. océanogr. Monaco, no. 377, p. 10, 1920.]

Three females of this species were taken from the 100-meter tow at station 35 off the Pacific end of the Panama Canal, and this was the only record for the cruise. It may be recognized by the strong curve of the frontal margin in lateral view and by the structure of the fifth legs. The species was reported by Sars (1925, p. 185) from the North Atlantic off the west coast of Scotland. This is the first record from the Pacific Ocean.

Amallothrix obtusifrons (G. O. Sars)

(Figure 128)

[*Amalophora obtusifrons* G. O. Sars, Bull. Mus. océanogr. Monaco, no. 26, p. 11, 1905.]

Not found in the Atlantic plankton, but present at four stations in the eastern Pacific and one in the central region. It was taken in 3 50-meter tows and 2 100-meter tows, but did not appear at the surface either by day or by night. It is probably negative to light, but gave no evidence of nocturnal migration. All the *Siboga* specimens were taken in vertical hauls from depths of 1000 to 1500 meters and none at the surface.¹

Amallothrix propinqua (G. O. Sars)

(Figure 123)

[*Scolecithricella propinqua* G. O. Sars, Bull. Inst. océanogr. Monaco, no. 377, p. 9, 1920.]

Not present in the Atlantic plankton, but present at one station in the eastern and four in the central tropical Pacific near the Samoan Islands. It was taken in 1 daytime surface tow, 1 50-meter tow, and 3 100-meter tows. The total number of specimens was very small, and only one of them was

¹ There is some question whether the data here given apply to this species or to *Scolecithricella obtusifrons*, which does not appear in this report. Since the author is deceased, it is not now possible to clear up the matter.—Ed.

found at the surface. The species was reported by Sars (1925, p. 178) from the temperate Atlantic, but these are the first records from the Pacific.

Amallothrix valida (Farran)

(Figures 7, 129)

[*Scolecithrix valida* Farran, Fisheries, Ireland, Sci. Invest. for 1906, pt. 2, p. 55, pl. 5, figs. 14-17; pl. 6, fig. 7, 1908.]

Two females were taken in the vertical tow from a depth of 1000 meters at station 64 in the southeastern region of the Pacific, and this is the only record for the cruise. Farran (1908b, p. 55) originally obtained the species from deep water off the west coast of Ireland, and it was present in two vertical tows of the *Siboga* plankton, one from 1000 and the other from 2000 meters. It would seem, therefore, that this is a deep-water species which usually keeps below the 100-meter level in the daytime.

Genus **ANOMALOCERA** Templeton, 1837

Anomalocera patersonii Templeton

(Figure 8)

[*Anomalocera patersonii* Templeton, Trans. Entomol. Soc. London, vol. 2, pt. 1, p. 35, pl. 5, 1837.]

This large and brilliantly colored species was found at two stations (9, 10) in the North Atlantic south of Greenland, and at two (113, 158) in the Pacific, the first off the coast of Japan and the second about 1000 miles northeast of the Samoan Islands. Except for a single specimen listed for the 100-meter tow only at station 113, all the *Carnegie* records for the species were made with surface nets. This individual may have slipped into the net at a higher level as it was being lifted. Since this species has never been reported except at the surface, it can be regarded as strongly positive to light. Like *Calanus finmarchicus*, it has sometimes been found in great shoals at or close to the surface, but no trace of anything of that sort occurred in the *Carnegie* plankton.

Genus **ARIETELLUS** Giesbrecht, 1892

Arietellus setosus Giesbrecht

(Figures 3, 4)

[*Arietellus setosus* Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, p. 415, pl. 29, figs. 1, 3-7, 9-13, 21; pl. 39, figs. 34-36, 1892.]

A few specimens, including both sexes, were found in the 100-meter tow at station 42, and this was the only record for the cruise. The species has been reported by Esterly (1911, p. 335) from the San Diego region, California, and he mentioned the rose color of the numerous setae from which the specific name is derived. This color was still very prominent in the *Carnegie* specimens after four years of preservation.

Genus **AUGAPTILUS** Giesbrecht, 1889

Augaptilus longicaudatus (Claus)

[*Hemicalanus longicaudatus* Claus, Die freilebenden Copepoden, p. 129, pl. 29, 1863.]

A single female was found at each of three stations in the eastern Pacific and nowhere else. Six specimens of this species were obtained in the *Siboga* plankton by vertical hauls from 750 to 1500 meters. This is probably another deep-water species which usually stays below the 100-meter level in the daytime. The caudal rami in this species are much longer than any of the abdominal segments.

Genus **BATHYCALANUS** G. O. Sars, 1905

Bathycalanus rigidus G. O. Sars

[*Bathycalanus rigidus* G. O. Sars, Bull. Inst. océanogr. Monaco, no. 377, p. 2, 1920.]

Six specimens of this species were found in the two deeper tows at station 118, and this is the only record for the cruise. According to Sars (1925, p. 19), this is a bathypelagic species and is found at considerable depths. It would seem as if it must come to the surface during the night, for otherwise these specimens would not have been found as far up as the 50-meter tow in the early forenoon.

Genus **CALANOPIA** Dana, 1853

Calanopia americana F. Dahl

(Figure 2)

[*Calanopia americana* F. Dahl, Ber. Naturforsch. Gesellsch. Freiburg, n. s., vol. 8, p. 21, pl. 1, figs. 23-26, 1894a.]

Found in small numbers at three stations in the Caribbean region, at two of the stations in the 50-meter tow and at the third station in the 100-meter tow. In these few instances, therefore, the species was negative to light, but they do not furnish sufficient data for any general conclusion. The specimens reported in the *Siboga* plankton came from Bermuda and, together with those here recorded, will establish the form as pelagic rather than littoral.

Calanopia elliptica (Dana)

(Figure 10)

[*Pontella elliptica* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 27, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1132, 1853; pl. 79, fig. 6a, b, 1855.]

A few females were taken at station 32 in the Caribbean, and both sexes were found abundantly near the Samoan Islands in the Pacific. The species was far more abundant in the *Siboga* plankton, where it was found in 32 surface tows, 10 of them taken during the night. Since it was captured at the surface here also, we may infer that it is usually positive to light.

Genus **CALANUS** Leach, 1819

This is one of the oldest and best-known copepod genera, and its species are widely distributed in every ocean and in all zones. One of its species attains the largest number of individuals among the copepods and is known to congregate in countless swarms to the exclusion of all other species. Seven species were present in the *Carnegie* plankton, three in the northern regions and the other four in the temperate and tropical regions.

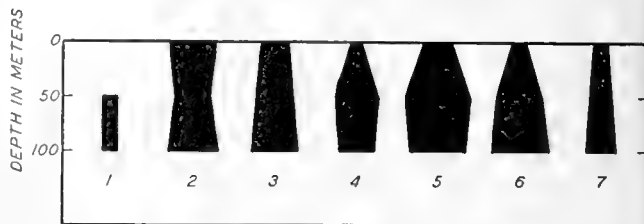


CHART 3. Daytime vertical distribution of species of *Calanus*: (1) *cristatus*, (2) *finmarchicus*, (3) *helgolandicus*, (4) *hyperboreus*, (5) *minor*, (6) *propinquus*, (7) *tonsus*. One species, *cristatus*, was confined to the two lower tows; the other six appeared at all three depths, but were more abundant in the deeper tows than at the surface. This was true even of *finmarchicus*, which was the only species that was least abundant at 50 meters.

Calanus cristatus Krøyer

[*Calanus cristatus* Krøyer, Voy. comm. sci. Nord. Scandinavie . . . la corvette "La Recherche," atlas, pl. 41, 1842-45; Naturhist. Tidsskr., Kjöbenhavn, ser. 2, vol. 2, pp. 547, 553, 607, 1848-1849.]

Found only at the Pacific stations north of latitude 40°, and hence, a boreal species. It was entirely confined to the two deeper tows, which indicates that it is negative to light, and its numbers were small except in the 100-meter tow at station 120. The specimens obtained had every appearance of being immature, since none could be found in which the rami of the fifth legs had more than two segments. The species has been recorded by Van Breemen (1907, p. 10) for the North Atlantic in the region traversed by the *Carnegie*, but did not appear in any of the tows taken in the Atlantic during the present cruise.

Calanus finmarchicus (Gunner)

[*Monoculus finmarchicus* Gunner, Skr. Kjöbenhavnske Selsk., vol. 10, p. 175, figs. 20-23, 1765.]

Like the preceding species, this well known copepod is a boreal form and except at station 130 was found only above latitude 40° in both oceans. It was present in 11 surface tows, 10 50-meter tows, and 13 100-meter tows. The fact that no trace was found of the countless swarms of this species reported from the North Atlantic may be due to the season of the year when the *Carnegie* tows were taken. It is possible that similar swarms might exist in Bering Sea north of the Aleutian Islands at the right time of year. The *Carnegie* records seem to substantiate Russell's (1928) statement that this species is negative to light at medium temperatures, but becomes positive at lower temperatures.

Calanus helgolandicus (Claus)

[*Cetochilus helgolandicus* Claus, Die freilebenden Copepoden, p. 171, pl. 26, figs. 2-9, 1863.]

This species was abundant over the entire Atlantic north of the equator but was found at only four stations in the Pacific. It was captured in 4 nocturnal and 16 diurnal surface tows, 18 50-meter tows, and 23 100-meter tows. It is also often found in about equal abundance at all three depths at

a station, and when it is restricted to a single depth this may be any one of the three indiscriminately. Accordingly it must be designated as fairly indifferent to light, but may become negative to the stronger light of the tropics.

Calanus hyperboreus Krøyer

[*Calanus hyperboreus* Krøyer, Kong. Danske Vidensk. Selsk., Naturvidensk. og. math. Afh., vol. 7, p. 310, pl. 4, 1838.]

As the specific name indicates, this is a boreal species and is confined to northern latitudes. It was not present in the *Carnegie* plankton from the North Atlantic, but has been reported from that region by Giesbrecht (1892, p. 91) and Sars (1925, p. 6). It was taken in the Pacific in 4 surface tows, 11 50-meter tows, and 10 100-meter tows, and development stages were abundant in 3 of the surface tows. Besides being larger than those of the preceding species, both the early stages and the adults were much darker and more opaque.

Calanus minor (Claus)

[*Cetochilus minor* Claus, Die freilebenden Copepoden, p. 172, 1863.]

Very widely distributed in both oceans, but with numerous gaps within which it was entirely absent from the plankton. It was present in 11 nocturnal and 32 diurnal surface tows, 73 50-meter tows, and 66 100-meter tows. Although it thus shows considerable preference for the two deeper tows, it was nevertheless often equally divided among the three depths. In many of the specimens taken in the tropics the setae of the caudal rami were more densely plumose than usual and tinged with red.

Calanus propinquus Brady

[*Calanus propinquus* Brady, Voyage of H.M.S. Challenger, Zool., vol. 8, pt. 23, Copepoda, p. 34, pl. 2, figs. 1-7; pl. 14, figs. 10, 11, 1883.]

In the Atlantic this species was almost entirely confined to the Caribbean region, but it was present in every region of the Pacific. Its distribution in the latter ocean, however, was very irregular, with numerous and extensive gaps. It was found in 7 nocturnal and 6 diurnal surface tows, 18 50-meter tows, and 23 100-meter tows. It thus showed a preference for the deeper tows in the daytime but came to the surface at night. The larger size and the pointed posterior corners of the fifth thoracic segment will distinguish the species.

Calanus tonsus Brady

[*Calanus tonsus* Brady, Voyage of H.M.S. Challenger, Zool., vol. 8, pt. 23, Copepoda, p. 34, pl. 4, figs. 8-9, 1883.]

This species was not found in the Atlantic plankton, although it has been reported from that ocean both north and south of the equator. In the Pacific it was practically confined to the eastern part south of the equator, where it was captured in 2 nocturnal and 2 diurnal surface tows, 3 50-meter tows, and 4 100-meter tows. It was originally reported by Brady (1883, p. 34) as from this locality as well as elsewhere, and was found by Farran (1929, p. 216) in the *Terra Nova* plankton south of New Zealand.

Genus *CALOCALANUS* Giesbrecht, 1888

Calocalanus pavo (Dana)

[*Calanus pavo* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 13, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1061, 1853; pl. 72, fig. 12a, b, 1855.]

This species was dispersed everywhere in both oceans except in the extreme northern parts, but usually in small numbers. The distribution, however, was very irregular, with numerous gaps and great variation in abundance. It was present in 5 nocturnal and 53 diurnal surface tows, 78 50-meter tows, and 65 100-meter tows. It is thus more or less indifferent to light and is often equally distributed at all three depths, or any two of them, at the same time. The four enlarged and fanlike plumes on each caudal ramus combined with the profuse armature of the anterior antennae give exceptional beauty to the living copepod. These are always broken off in preserved material, and the specimens have a ragged and uncouth appearance.

Calocalanus plumulosus (Claus)

(Figure 18)

[*Calanus plumulosus* Claus, Die freilebenden Copepoden, p. 174, pl. 26, figs. 15, 16, 1863.]

Not present in the Atlantic plankton but fairly well distributed in the Pacific, where it was taken in 10 nocturnal and 5 diurnal surface tows, 25 50-meter tows, and 25 100-meter tows. When alive this copepod carries an enormous plume on the left caudal ramus, but this is never seen on a preserved specimen. Furthermore, all the appendages are so brittle that they are usually broken and it is very rare to find a specimen with anything except the fifth legs intact. Fortunately these legs are quite characteristic and will serve to identify the species.

Calocalanus styliremis Giesbrecht

(Figures 12, 14)

[*Calocalanus styliremis* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 333, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 176, 185, pl. 9, figs. 15, 18, 29; pl. 36, figs. 46-48, 1892.]

Found in the Sargasso and Caribbean regions and widely dispersed in the Pacific. The distribution in the latter ocean is such that the species is of rare occurrence although found 44 times from station 40 to station 159. It was taken in 16 diurnal surface tows, 32 50-meter tows, and 23 100-meter tows. It is thus negative at least to strong light.

Genus *CANDACIA* Dana, 1846

This is a temperate and tropical genus and was not found north of latitude 50° in the Atlantic or 40° in the Pacific. Several of the species have a world-wide distribution and most of them were more abundant in the deeper tows than at the surface. See chart 4, on following page.

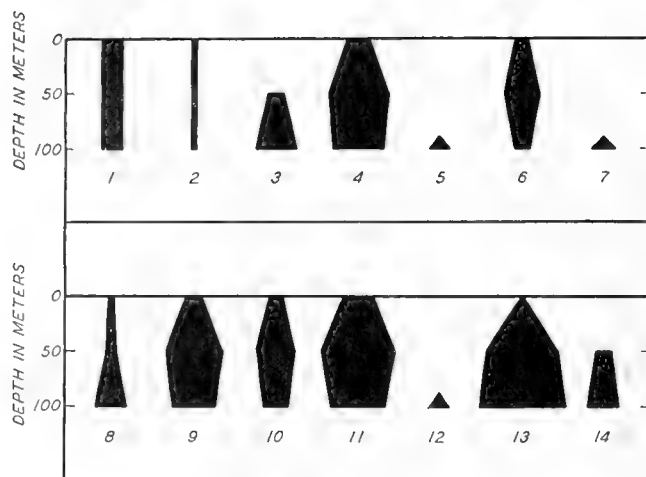


CHART 4. Daytime vertical distribution of species of *Candacia*: (1) *aethiopica*, (2) *armata*, (3) *bipinnata*, (4) *bispinosa*, (5) *catula*, (6) *curta*, (7) *falcifera*, (8) *longimana*, (9) *norvegica*, (10) *pachydactyla*, (11) *simplex*, (12) *tenuimana*, (13) *truncata*, (14) *varicans*. Three of the fourteen species were confined to the 100-meter tow and two others to the two deeper tows. Of the nine species present in all three tows, two were equally distributed, two were more abundant in the 100-meter tow, and five were more abundant in the 50-meter tow.

Candacia aethiopica (Dana)

[*Candacia aethiopica* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 23, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1115, 1853; pl. 78, fig. 5a-e, 1855.]

Found in the temperate and tropical Atlantic and in the eastern and central tropical Pacific. It was present in 4 nocturnal and 8 diurnal surface tows, 8 50-meter tows, and 7 100-meter tows. These records indicate that it is more or less indifferent to ordinary light, but becomes negative to the strong light of the tropics, where it is found more often in the two deeper tows. The legs and the entire thorax behind the head are so dark a brown as to appear virtually black, and thus serve to distinguish the species. In the *Siboga* plankton this species was found more often at the surface than in the deep vertical tows.

Candacia armata (Boeck)

[*Candace armata* Boeck, Forhandl. Vidensk. Selsk. Christiania, vol. 14, p. 39, 1872.]

Found once in the eastern Pacific and three times in the western part off the coast of Japan, being present in each of the three tows. Although it was not found in the *Carnegie* plankton from the Atlantic, it has been reported from the North Atlantic by Cleve (1900-1901, p. 141; 1900b, p. 51; as *Candace pectinata*). Sars in his *Crustacea of Norway* (1902, p. 135) stated that all the specimens of this species which he procured from the coasts of Norway were near the surface of the sea, and this would make them positive to light. The species may be recognized by the peculiar asymmetry of the urosome in the female and the genital segment in the male.

Candacia bipinnata (Giesbrecht)

[*Candace bipinnata* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 1, p. 815, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 424, 439, pl. 22, fig. 20; pl. 39, figs. 27, 29, 1892.]

Found only in the Pacific at widely separated localities, once at the surface in a nocturnal tow, twice in the 50-meter tow in the daytime, and five times in the 100-meter tow. These few specimens thus show a definite negative phototropism, but are not numerous enough to warrant a general conclusion. This was reported by Farran (1929, p. 272) as the most plentiful species of the genus off the coast of New Zealand, and it has also been reported from the North and South Atlantic.

Candacia bispinosa (Claus)

(Figure 9)

[*Candace bispinosa* Claus, Die freilebenden Copepoden, p. 191, pls. 27, 28, 1863.]

Found in the temperate and tropical Atlantic and in the eastern and central Pacific south of the equator, also north of the equator in the western Pacific, reaching latitude 40°. It was present in 14 nocturnal and 19 diurnal surface tows, 45 50-meter tows, and 45 100-meter tows. These records indicate a preference for the two deeper tows, but also a frequent occurrence at the surface both by day and by night. Next to *simplex* this was the most widely distributed species of the genus, and the number of specimens reached into the hundreds, in sharp contrast with the 3 which constituted the total for the *Siboga* plankton.

Candacia catula (Giesbrecht)

[*Candace catula* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 1, p. 815, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 425, 440, pl. 21, fig. 13; pl. 22, figs. 3, 27, 28, 1892.]

A single female of this species was found in the 100-meter tow at station 155 in the central Pacific close to the equator. Again we find a sharp contrast with the *Siboga* plankton, in which this species was found to be well distributed over the Pacific. Many of the captures, however, were made in vertical hauls from considerable depths, hence it is possible that this species descends below the 100-meter level and remains there in the daytime, and thus escaped most of the *Carnegie* tows.

Candacia curta (Dana)

(Figure 19)

[*Candace curta* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 23, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1116, 1853; pl. 78, fig. 6a-d, 1855.]

Found in the eastern Pacific close to the equator and in the western Pacific north of the equator. It was taken in 2 surface tows, 5 50-meter tows, and 2 100-meter tows, with a total for all the tows of 21 specimens. The species has been reported from the California coast by Esterly (1905, p. 196) and from the tropical Atlantic by Cleve (1904, p. 186), but did not occur in the *Carnegie* plankton from the Atlantic.

Candacia falcifera Farran

(Figure 13)

[*Candacia falcifera* Farran, British Antarctic (Terra Nova) Exped., pt. 10, Zool., vol. 8, no. 3, p. 270, fig. 28, 1929.]

Two females were obtained from the 100-meter tow at station 23 in the tropical Atlantic, and this was the only record for the cruise. Although the species was established by Farran (1929, p. 270) on specimens obtained by the *Terra Nova* expedition in the Antarctic south of New Zealand, these 2 tropical Atlantic specimens show exactly the same characteristics, especially as regards the fifth legs (fig. 13).

Candacia longimana (Claus)

(Figure 26)

[*Candace longimana* Claus, Die freilebenden Copepoden, p. 140, pl. 27, 1863.]

Not found in the Atlantic plankton but widely and very irregularly dispersed in the eastern, central, and western Pacific within the tropics. It was taken in 2 surface tows, 3 50-meter tows, and 9 100-meter tows, and in every instance the abundance record was 5 or less. The small, curved, and shriveled spine at the right posterior corner of the fifth thoracic segment is a good character for identifying the species.

Candacia norvegica (Boeck)

(Figure 6)

[*Candace norvegica* Boeck, Forhandl. Vidensk. Selsk. Christiania, p. 235, 1865.]

Found near latitude 40° in the western part of the North Atlantic, in the Sargasso and Caribbean regions, and in the eastern, central, and western Pacific. It was present in 12 nocturnal and 4 diurnal surface tows, 22 50-meter tows, and 15 100-meter tows. It thus preferred the two deeper tows during the daytime but migrated frequently to the surface at night.

Candacia pachydactyla (Dana)

(Figure 15)

[*Candace pachydactyla* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 23, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1113, 1853; pl. 78, figs. 2a, b, 3a, b, 4a-c, 1855.]

Found in the central and Caribbean regions of the Atlantic and chiefly in the eastern part of the Pacific. It was taken in 2 nocturnal and 3 diurnal surface tows, 9 50-meter tows, and 7 100-meter tows, but the number of specimens was too small for any general statement. A. Scott (1909, p. 153) listed it as moderately common in the *Siboga* plankton and stated that it was widely distributed in tropical seas. The *Carnegie* records would probably have been more numerous had the tows been taken below 100 meters.

Candacia simplex (Giesbrecht)

(Figures 16, 17)

[*Candace simplex* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 1, p. 815, 1889; Fauna und Flora des Golfes

von Neapel, vol. 19, pp. 424, 440, pl. 21, figs. 10, 21, 25, 30, 31; pl. 22, figs. 21, 29; pl. 39, figs. 3, 14, 1892.]

This was the most widely distributed of all the *Candacia* species in both oceans, especially in the Pacific, where it was found in every region except the extreme north. It was taken in 16 nocturnal and 32 diurnal surface tows, 73 50-meter tows, and 58 100-meter tows. In the daytime, therefore, it was more often present in the deeper tows, especially at 50 meters. But it was frequently equally distributed in all three tows at the same time, and was seldom restricted to a single depth. Wherever it remains during the day, it evidently migrates regularly to the surface at night, since it appeared in so many of the nocturnal tows.

Candacia tenuimana (Giesbrecht)

[*Candace tenuimana* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 1, p. 814, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 424, 439, pl. 21, figs. 8, 28, 29; pl. 22, figs. 2, 30, 37, 1892.]

A single female was captured in the 100-meter tow at station 115 off the Japan coast in the Pacific, and this was the only record. The *Siboga* plankton yielded 2 specimens in a vertical haul from a depth of 1500 meters. This suggests not only that the species is rare, but also that it is more likely to be found in the depths below the 100-meter level. It has been reported from the South Atlantic by Cleve (1904, p. 187) and from the western Mediterranean and the tropical Pacific by Giesbrecht (1898, p. 128).

Candacia truncata (Dana)

(Figure 11)

[*Candace truncata* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 24, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1118, 1853; pl. 78, fig. 8a-d, 1855.]

This species was not found in the Atlantic plankton, but was well distributed in the eastern and western Pacific and lacking in the northern part. It was found in 3 nocturnal and 1 diurnal surface tows, 24 50-meter tows, and 25 100-meter tows. In the daytime, therefore, it was practically confined to the two deeper levels, but at night it migrated occasionally to the surface. In the *Siboga* plankton it was found in 33 of the surface tows, 10 of which were nocturnal, and in 7 vertical tows from considerable depths.

Candacia varicans (Giesbrecht)

[*Candace varicans* Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, pp. 424, 439, pl. 21, figs. 3, 4, 11, 24; pl. 22, figs. 10, 25; pl. 39, figs. 2, 23, 1892.]

Found in the tropical region of the Atlantic and in the western Pacific; entirely confined to the two deeper levels, appearing in 5 50-meter tows and 9 100-meter tows. It was obtained originally by Giesbrecht (1892, p. 424) from the Mediterranean, but has been reported from the North Atlantic and the South Pacific, off the New Zealand coast. The structure of the fifth legs, especially those of the male, furnishes a ready means of identifying the species.

Genus *CANTHOCALANUS* A. Scott, 1909*Canthocalanus pauper* (Giesbrecht)

[*Calanus pauper* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 331, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 91, 129, pl. 6, fig. 4; pl. 8, fig. 25, 1892.]

Not present in the Atlantic plankton but well scattered over the Pacific, with, however, five large gaps in its distribution, one each in the northern, eastern, southern, central, and western regions. It was taken in 5 nocturnal and 20 diurnal surface tows, 33 50-meter tows, and 30 100-meter tows. These records indicate more or less indifference to light, and this conclusion is supported by the fact that the species was found equally distributed in all three tows at the same time, or in two of them. On the other hand, it was found more often in the two deeper tows during the day, and probably becomes negative as the intensity of the light increases. It is worthy of note that this species was captured only in surface tows during the *Siboga* expedition and not in any of the vertical tows from different depths.

Genus *CARNEGIELLA*, new genus

Body of typical cyclops form, metasome five times as wide as urosome, considerably swollen dorsally and ventrally. First antennae slender, six-segmented, the terminal segment linear and four times as long as the rest of the antenna. Second antenna uniramous and five-segmented; maxillipeds chelate; rami of first four pairs of legs three-segmented; fifth legs lacking in the female; male unknown.

Genotype. Carnegiella gracilis (Cyclopoida).

Carnegiella gracilis, new species

(Figures 20-25)

Occurrence. A single female was found in the 100-meter tow at station 151 north of Samoa in the central Pacific.

Description of female. Metasome pyriform, a little more than twice as long as wide, widest at the center and strongly narrowed anteriorly and posteriorly. Head fused with the first thoracic segment and much longer than the free thorax. Urosome six-segmented, much narrower than fourth segment of metasome, about same width throughout. Genital segment longer but scarcely wider than any of the abdominal segments; the latter all of about the same length and width except the anal segment, which is widened posteriorly. Caudal rami longer than the anal segment and pointed posteriorly, where each is armed with three setae, one on the outer and two on the inner margin. Between the setae the lamina of the ramus projects backward and ends in two processes, the outer one longer than the inner and tipped with a hair.

The first antennae are six-jointed, the five basal joints moderately swollen and tapering distally. The terminal segment is linear and four times as long as the other five segments combined. The fourth segment carries an aesthetask which is linear and closely appressed to the terminal segment, and reaches slightly beyond the tip of the latter. The

second, third, and fourth segments are setose, but the long terminal segment is naked except for a tuft of setae at its very tip.

The second antennae are uniramous, slender, and five-segmented, the third segment the longest and the fourth segment the shortest. The basal segment carries a small seta on its inner margin, the fourth segment has a similar one on its outer margin at the distal corner, and the terminal segment is tipped with a single larger seta. The mandibles and maxillae were not removed for examination, as this would have destroyed the solitary specimen. The maxillipeds are two-segmented, rather stout, with a chela at the tip of the second segment.

The first four pairs of legs are biramous and each ramus is three-segmented; the armature of these legs is very peculiar, as can be seen from figures 24 and 25. In the first and second legs the spines on the outer margins of the exopods are arranged 1, 1, 2 and are normally developed. In the third and fourth legs the spine on the basal segment is reduced to a tiny rudiment, the one on the middle segment is somewhat better developed, and there is but one on the end segment at the distal corner. The first endopod carries on the outer margin of each of its three segments a single seta; on the inner margins there are one, two, and three setae respectively, and two more at the tip of the third segment, eleven in all, which is an exceptionally large number for a first endopod. The third and fourth endopods have no setae on the outer margin, and on the inner margin there are one, two, and two respectively on the three segments, with a single seta at the end of the third segment, six in all.

Total length, 1.25 mm; length of metasome, 0.85 mm; length of urosome, 0.45 mm.

Type. U. S. Nat. Mus. no. 64002.

Remarks. This species is distinguished by the exceptional length and linearity of the last segment of the first antennae, by the structure of the maxillipeds and the caudal rami, and by the armature of the swimming legs.

Genus *CENTRAUGAPTILUS* G. O. Sars, 1920*Centraugaptilus rattrayi* (T. Scott)

[*Augaptilus rattrayi* T. Scott, Trans. Linn. Soc. London, ser. 2, Zool., vol. 6, pt. 1, p. 36, pl. 2, figs. 25-37, 1894.]

A few badly preserved specimens of this species were obtained in the 100-meter tow at station 23 in the tropical Atlantic. It was first described by T. Scott (1894, p. 36) as from the Gulf of Guinea, but was afterward reported from various localities in the North Atlantic by Farran (1908b, p. 78) and Sars (1925, p. 304).

Genus *CENTROPAGES* Krøyer, 1849

This genus was well distributed in both oceans except in the northern parts and the southern part of the Pacific, and was more abundant in the tropics. Although most of the species are pelagic in habitat, some of them come close to shore and even enter the mouths of rivers and harbors. See chart 5, on following page.

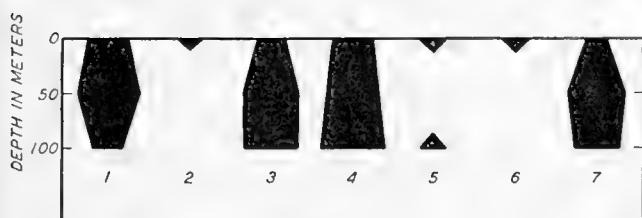


CHART 5. Daytime vertical distribution of species of *Centropages*: (1) *calaninus*, (2) *chierchiaie*, (3) *elongatus*, (4) *furcatus*, (5) *hamatus*, (6) *typicus*, (7) *violaceus*. Two of the species were confined to the surface tow, and one appeared both at the surface and in the 100-meter tow, but not in the 50-meter tow. Four were present at each of the three depths, one of these being least abundant in the 100-meter tow and the remaining three least abundant at the surface.

Centropages calaninus (Dana)

(Figure 30)

[*Cyclopsina calanina* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 25, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, pp. 1105, 1106, 1853; pl. 78, fig. 10a, b, 1855.]

Not found in the Atlantic plankton, but dispersed over the entire Pacific with two extensive gaps in distribution, one in the southeastern part, the other in the extreme north. It was present in 13 nocturnal and 34 diurnal surface tows, 41 50-meter tows, and 25 100-meter tows, and in the vertical tow from 1000 meters, station 64. It was sometimes present equally in each of the three tows at the same time, but was found more often in the two upper tows. More than half the abundance records are expressed in numerals, indicating a paucity in the number of individuals.

Centropages chierchiaie Giesbrecht

[*Centropages chierchiaie* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 1, p. 811, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 304, 320, pl. 17, figs. 38, 39, 45; pl. 18, fig. 5; pl. 38, figs. 3, 7, 1892.]

Three specimens of this species, including both sexes, were obtained in the surface tow at station 2 near the Sargasso region, and this was the only record for the cruise. This species was originally obtained by Giesbrecht (1892, p. 304) from the Strait of Gibraltar, and has since been reported from the North Atlantic by Cleve (1904, p. 187) and from the Indian Ocean by Thompson and Scott (1903, p. 246).

Centropages elongatus Giesbrecht

[*Centropages elongatus* Giesbrecht, Zool. Jahrb., Abth. Syst., vol. 9, p. 322, pl. 5, figs. 3-6, 1896.]

Not present in the Atlantic plankton, but found once in the southeastern Pacific, once in the extreme western part, and at most of the stations between the Hawaiian Islands and Samoa. It was taken in 1 nocturnal and 4 diurnal surface tows, 11 50-meter tows, and 11 100-meter tows. It was thus largely confined to the two deeper tows, but gave evidence of migration to the surface at night. The appendages of this copepod seem exceptionally brittle; nearly every specimen was

badly mutilated, though the other copepods in the same tow were well preserved.

Centropages furcatus (Dana)

[*Catopia furcata* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 25, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1173, 1853; pl. 74, fig. 1a-d, 1855.]

Well distributed in the Atlantic except at the extreme north, and in the Pacific confined to the eastern and central parts. It was present in 7 nocturnal and 16 diurnal surface tows, 19 50-meter tows, and 21 100-meter tows. It was thus quite evenly divided among the three depths and often appeared in them all at the same time. The long caudal rami and the small accessory spines inside the larger ones at the posterior corners of the fifth thoracic segment easily identify the species.

Centropages hamatus (Lilljeborg)

[*Ichthyophorba hamata* Lilljeborg, De crustaceis ex ordinibus tribus: Cladocera, Ostracoda et Copepoda, in Scania occurrentibus, p. 185, pls. 21, 26, 1853.]

Found at six localities in the Atlantic and at only two in the Pacific, in 4 nocturnal and 4 diurnal surface tows and 2 100-meter tows, but nowhere in a 50-meter tow. Sars in his *Crustacea of Norway* (1902, p. 76) said of this species, "It is a true pelagic form, occurring as a rule close to the surface of the sea." And yet he found it common in the fjords and along the whole coast of Norway, and it is one of the species that frequently comes into harbors and estuaries. It is widely distributed in the North Atlantic and occurs in sufficient abundance to form an essential factor in the food of certain pelagic fishes.

Centropages typicus Krøyer

[*Centropages typicus* Krøyer, Naturhist. Tidsskr., Kjöbenhavn, ser. 2, vol. 2, p. 588, pl. 6, 1849.]

Found only in the surface tow at station 6 in the Atlantic southwest of England, and not at all in the Pacific. Sars in his *Crustacea of Norway* (1902, p. 75) said of this species, "We are justified in regarding it as a true Atlantic form. Off the Norwegian coast it occurs both in the open sea and in the fjords, being often found in considerable abundance at the very surface of the sea." About the same may be said of it along the eastern coast of North America, where it seems to be more of a littoral than a pelagic form, entering most of the harbors and estuaries, and showing a decided preference for the surface.

Centropages violaceus (Claus)

[*Ichthyophorba violacea* Claus, Die freilebenden Copepoden, p. 199, pl. 35, figs. 13, 14, 1863.]

Found in and near the Sargasso region and in the central Pacific about 1000 miles east and southeast of the Hawaiian Islands. It was present in 1 nocturnal and 3 diurnal surface tows, 9 50-meter tows, and 6 100-meter tows. It appeared thus chiefly in the two deeper tows, but its presence in the nocturnal tow shows that it migrates to the surface at night. It was not found in either the *Challenger* or the *Siboga* plankton, the specimens named *violaceus* by Brady (1883,

p. 83) being a different species, but it has been reported by Farran (1929, p. 255) from the Atlantic and the South Pacific. The lateral margins of the metasome are often indented at every joint, giving the body a peculiar nodal appearance.

Genus **CHIRIDIELLA** G. O. Sars, 1907

Chiridiella species

Only one of the three species accredited to this genus, all of which occur in the Atlantic, has ever been reported from the Pacific. The three tiny representatives of this genus taken in the vertical tow from 1000 meters at station 64 are too immature to admit identification with the species *C. macrodactyla* Sars, which does occur in the Pacific. From the manner in which the haul was made, it is impossible to say at which level the specimen was captured between 1000 meters and the surface.

Genus **CHIRIDIUS** Giesbrecht, 1892

Chiridius poppei Giesbrecht

[*Chiridius poppei* Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, p. 224, pl. 14, figs. 14-18, 1892.]

A single female, not fully developed but apparently belonging to this species, was taken in the vertical haul from a depth of 1000 meters at station 64 in the southeastern Pacific, also 2 specimens (juvenile males) were found in 50-meter tows off the coast of Japan. It is worthy of note that 5 of the 6 specimens obtained in the *Siboga* plankton were taken in vertical hauls from depths of 700 to 1500 meters. This indicates that the species is a deep-water form and not likely to be found in the upper 100 meters except at night. It was reported in a surface haul off New Zealand by Farran (1929, p. 255), but the time at which the tow was taken was not given.

Genus **CLAUSOCALANUS** Giesbrecht, 1888

Clausocalanus arcuicornis (Dana)

[*Calanus arcuicornis* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 12, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1056, 1853; pl. 72, fig. 7a, b, 1855.]

Found in all the Atlantic plankton except at the far north, and at practically every locality in the Pacific, often very abundant. It was taken in 29 nocturnal and 76 diurnal surface tows, 93 50-meter tows, and 92 100-meter tows, and in the vertical tow from 1000 meters at station 64. It was also frequently found at all three depths in equal abundance, and was very seldom restricted to a single depth. Such a vertical distribution indicates indifference to light under normal conditions, and its horizontal or geographical distribution indicates that it is equally indifferent to temperature, except in extremes. It evidently stays at the surface during the night, but is found somewhat more often in the two deeper tows during the day.

Clausocalanus furcatus (Brady)

(Figures 27-29)

[*Drepanopus furcatus* Brady, Voyage of H.M.S. Challenger, Zool., vol. 8, pt. 23, Copepoda, p. 77, pls. 4, 24, 1883.]

Not found in the Atlantic plankton, but abundant in the eastern, southern, and central parts of the Pacific, though not in the western and northern parts. It was present in 22 nocturnal and 28 diurnal surface tows, 30 50-meter tows, and 40 100-meter tows. Like the preceding species, it was often taken equally at all three depths at the same time. In the *Siboga* plankton it was found in 24 surface tows, 10 of them at night, and 10 vertical hauls from considerable depths. In the tropics, where the light was strongest, it was often confined to the deeper tows.

Genus **CLYTEMNESTRA** Dana, 1847

Clytemnestra rostrata (Brady)

[*Goniopsyllus rostratus* Brady, Voyage of H.M.S. Challenger, Zool., vol. 8, pt. 23, Copepoda, p. 107, pl. 42, figs. 9-16, 1883.]

Found only at station 8 southeast of Iceland in the Atlantic, but scattered irregularly over the entire Pacific and common in the central region. It was taken in 5 nocturnal surface tows, 16 50-meter tows, and 28 100-meter tows. Its absence from the diurnal surface tows shows that it is negative to light, and its presence in the nocturnal surface tows shows that it migrates to the surface at night. It is worthy of note that the 5 specimens from the *Siboga* plankton were all captured at or near the surface.

Clytemnestra scutellata Dana

[*Clytemnestra scutellata* Dana, Proc. Amer. Acad. Arts and Sci., vol. 1, p. 153, 1847; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1194, 1853; pl. 83, fig. 12a-f, 1855.]

This species was found at ten of the Atlantic localities and its Pacific distribution was similar to that of the preceding species, but it was somewhat more abundant. It was present in 4 nocturnal and 2 diurnal surface tows, 35 50-meter tows, and 39 100-meter tows. In view of its comparative abundance in the *Carnegie* plankton, it seems strange that this species did not appear at all in either the *Challenger* or the *Siboga* plankton. Like *rostrata*, it is negative to light and prefers the two deeper tows during the daytime, but migrates to the surface at night.

Genus **CONAEA** Giesbrecht, 1891

Conaea gracilis (Dana)

[*Antaria gracilis* Dana, U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1229, 1853; pl. 86, fig. 11a-d, 1855.]

A few specimens were found in the two deeper tows at station 35 off the Pacific end of the Panama Canal, and this was the only record for the cruise. It is worthy of comment that all the 15 specimens of this species in the *Siboga* plankton were captured in vertical hauls from depths of 700 to

2000 meters. This strongly suggests that the copepod is a deep-water form which could be expected only rarely in the upper 100 meters.

Genus *COPILIA* Dana, 1849

This genus is widely distributed in tropical and temperate oceans, chiefly the former. All its species showed a preference for the deeper levels, but *denticulata* was often, and *quadrata* rarely, found at the surface. The species were also more or less gregarious, occurring together at consecutive stations in some localities, and entirely absent from the plankton in others, often for long distances.

Copilia denticulata Claus

[*Copilia denticulata* Claus, Die freilebenden Copepoden, p. 161, pl. 25, 1863.]

Found at eight Atlantic localities, and irregularly scattered over the entire Pacific with large gaps in the southeastern and northern parts. It was present in 3 nocturnal and 24 diurnal surface tows, 48 50-meter tows, and 31 100-meter tows. It was thus found most frequently at the deeper levels in the daytime, especially at the 50-meter level, but migrated to the surface sometimes at night.

Copilia mirabilis Dana

[*Copilia mirabilis* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 40, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1232, 1853; pl. 86, fig. 14a, b, 1855.]

Not present in the Atlantic plankton, but found at five stations in the Pacific, one in the southeastern part and four in the western part. At two of the stations the species was in the 50-meter tow, at two others in the 100-meter tow, and only once at the surface. In the *Siboga* plankton this species was captured in 47 surface tows, 10 of which were nocturnal, and in 8 vertical tows from considerable depths. As no simultaneous tows at different depths were taken on the *Siboga* expedition, the most that can be said is that this copepod has been taken so often at the surface in the daytime that it must be at least indifferent if not positive to light.

Copilia quadrata Dana

[*Copilia quadrata* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 40, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1233, 1853; pl. 86, fig. 15a-d, 1855.]

Not present in the Atlantic plankton, but well scattered over the Pacific, with large gaps in distribution in the southeastern and northern parts. It was taken in 1 nocturnal and 4 diurnal surface tows, 5 50-meter tows, and 33 100-meter tows. Accordingly it was almost entirely confined to the two deeper tows, especially the 100-meter tow, in the daytime, and must be negative to light. During the *Siboga* expedition it was taken in 21 surface tows, 6 of which were nocturnal.

Copilia recta Giesbrecht

[*Copilia recta* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 480, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 648, 658, pl. 50, fig. 4, 1892.]

This species was confined to four stations in the western Pacific between the Mariana Islands and Japan, and was present only in the two deeper tows, not appearing at the surface. As far as is known, this copepod has been reported only from the tropical Pacific and does not appear in any of the lists of the larger plankton expeditions.

Copilia vitrea (Haeckel)

[*Hyalophyllum vitreum* Haeckel, Ztschr. f. Med. u. Naturwiss., Jena, vol. 1, p. 63, pl. 1, 1864.]

Not present in the Atlantic plankton, but irregularly scattered at many stations long distances apart in the Pacific. It was found in 8 50-meter tows and 7 100-meter tows, but did not appear at the surface. Although not found in the Atlantic during the present cruise, it has been reported from the tropical Atlantic by Giesbrecht (1892, p. 647).

Genus *CORYCAEUS* Dana, 1845

The genus *Corycaeus* is confined to the temperate and tropical regions and is rarely found above latitude 40° north or below 40° south. It belongs, furthermore, to the epiplankton, and the species are all found within the upper 100 meters. In spite of this, the vertical distribution of the various species shows considerable diversity; see chart 6, on page 180. The names of the species are those given in the admirable monograph on the Corycaeidae by Maria Dahl (1912), but it has not been deemed necessary to include the subgenera.

Corycaeus agilis Dana

[*Corycaeus agilis* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 37, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, pp. 1217, 1218, 1853; pl. 85, fig. 10a, b, 1855.]

Found at six localities in the Sargasso and Caribbean regions, and irregularly scattered over the entire Pacific except the north, but more abundant in the southeastern part. It was taken in 44 surface tows, 17 50-meter tows, and 11 100-meter tows, and is thus a surface species, having a larger surface predominance than any of the other species.

Corycaeus andrewsi Farran

(Figure 36)

[*Corycaeus andrewsi* Farran, Proc. Zool. Soc. London, 1911, p. 294, pl. 13, figs. 7-9; pl. 14, figs. 1-4, 1911.]

This species was not present in the Atlantic plankton, and in the Pacific was found chiefly in the southeastern part. It was taken in 1 nocturnal and 5 diurnal surface tows, 3 50-meter tows, and 6 100-meter tows. Farran's (1911, p. 294) original specimens were obtained in shallow water near the shore of Christmas Island in the Indian Ocean, but other specimens of both sexes were subsequently found by Maria Dahl (1912, p. 78) in the western tropical Pacific.

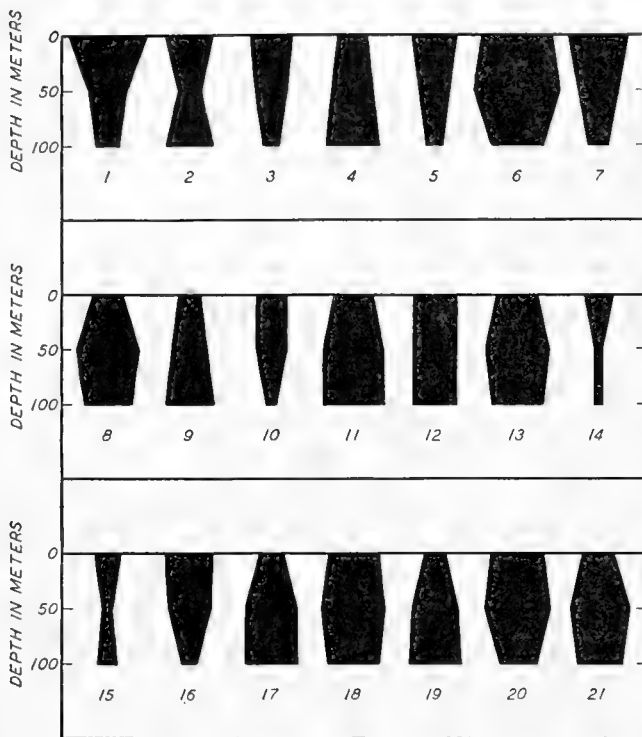


CHART 6. Daytime vertical distribution of species of *Corycaeus*: (1) *agilis*, (2) *andrewsi*, (3) *anglicus*, (4) *catus*, (5) *clausi*, (6) *crassiusculus*, (7) *dubius*, (8) *flaccus*, (9) *furcifer*, (10) *giesbrechti*, (11) *lautus*, (12) *limbatus*, (13) *longistylis*, (14) *lubbockii*, (15) *minimus*, (16) *ovalis*, (17) *pacificus*, (18) *pumilus*, (19) *robustus*, (20) *speciosus*, (21) *typicus*. Each species was found somewhere at each of the three depths. Seven were least abundant in the 100-meter tow, more abundant in the 50-meter tow, and most abundant at the surface. Five were just the reverse, least abundant at the surface and most abundant in the 100-meter tow. Six were most abundant in the 50-meter tow and less abundant in the other two tows; two were least abundant in the 50-meter tow, and one was equally abundant in all three tows.

Corycaeus anglicus Lubbock

(Figure 43)

[*Corycaeus anglicus* Lubbock, Ann. and Mag. Nat. Hist., ser. 2, vol. 20, p. 408, pl. 11, figs. 14-17, 1857.]

Found at five localities in the western and Caribbean regions of the Atlantic and at ten stations in the Pacific, chiefly in the central part. It was present in 9 surface tows, 4 50-meter tows, and 3 100-meter tows. It has been taken hitherto chiefly in the northern Atlantic, and has been pronounced by Sars in his *Crustacea of Norway* (1918, p. 196) "a pronouncedly pelagic animal, which has its true home in the open sea and only quite accidentally is thrown by the currents nearer to the shores." From these *Carnegie* records it would seem to prefer the surface rather than the greater depths, and this agrees with the statements of other observers.

Corycaeus catus F. Dahl

[*Corycaeus catus* F. Dahl, Verhandl. Deut. zool. Gesellsch., vol. 4, München, p. 72, 1894b.]

This species was not present in the Atlantic plankton, but was widely scattered over the Pacific, with large gaps in the distribution. It was taken 19 times in the 100-meter tow, 17 times in the 50-meter tow, and 14 times at the surface in the daytime and 9 times at night. It thus shows a slight preference for the greater depths during the day, but migrates rather regularly to the surface at night. Only the females of the species were known at first, and its validity was in doubt, but the descriptions and figures of both sexes by Maria Dahl (1912, p. 99) fully established it.

Corycaeus clausi F. Dahl

(Figure 42)

[*Corycaeus clausi* F. Dahl, Verhandl. Deut. zool. Gesellsch., vol. 4, München, p. 73, 1894b.]

This species was present twice in the Atlantic plankton, one of the localities being a nocturnal surface tow; it was also taken in 3 nocturnal surface tows in the Pacific. In the daytime it was found in 8 surface tows, 4 50-meter tows, and 2 100-meter tows. It is evidently not abundant anywhere, and in these few *Carnegie* records showed a preference for the surface rather than for the deeper tows. From the records of other investigators it would seem to be more of an Atlantic than a Pacific form.

Corycaeus crassiusculus Dana

[*Corycaeus crassiusculus* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 36, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, p. 1214, 1853; pl. 85, fig. 7, 1855.]

This is the most widely distributed and most abundant species of the genus, and was found everywhere in both oceans except in the far north and in the four southernmost stations of the Pacific. It was taken in 16 nocturnal and 84 diurnal surface tows, 103 50-meter tows, and 77 100-meter tows, and was frequently found in all three tows at the same station. These records indicate more or less indifference to light, with a moderate preference for the 50-meter tow. Dana (1849, pp. 36, 38; 1853, pp. 1214, 1222) originally described a male, *crassiusculus*, and a female, *venustus*, in the same paper, and these have since been identified as the two sexes of the same species. Hence the name of the male, described first, must be taken for both sexes, and the name of the female dropped.

Corycaeus dubius Farran

(Figure 40)

[*Corycaeus dubius* Farran, Proc. Zool. Soc. London, 1911, pp. 292-294, pl. 12, fig. 7; pl. 14, figs. 5-9, 1911.]

Found at four stations in the middle and Caribbean regions of the Atlantic and widely scattered over the Pacific. But the gaps in its distribution are so numerous that it was scarcely found anywhere at two stations in succession. It was captured in 19 surface tows, 12 50-meter tows, and 5 100-meter tows. These records show a preference for the two upper tows, especially for the surface tow, but the species was not present in any of the nocturnal surface tows. Originally founded somewhat doubtfully, as its name suggests, on a single female,

the species was made valid a year later with descriptions and figures of both sexes.

***Corycaeus flaccus* Giesbrecht**

(Figure 50)

[*Corycaeus flaccus* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 480, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 659-674, pl. 51, figs. 10, 11, 1892.]

Found at the first three localities in the Atlantic, in the Caribbean, and in every region of the Pacific, except above 40° north latitude, but with numerous and extensive gaps. It was present in 4 nocturnal surface tows, and in the daytime was taken in 10 surface tows, 22 50-meter tows, and 18 100-meter tows, and in the vertical tow from 1000 meters at station 64. It may be recognized in side view by the small knob projecting from the distal end of the dorsal surface of the genital segment.

***Corycaeus furcifer* Claus**

[*Corycaeus furcifer* Claus, Die freilebenden Copepoden, p. 157, pl. 24, 1863.]

Found at station 32 in the Caribbean, and, like the preceding species, scattered in every region of the Pacific with numerous and extensive gaps in distribution, but not above 40° north latitude. It was taken in 1 nocturnal surface tow, and in the daytime was present in 3 surface tows, 6 50-meter tows, and 8 100-meter tows. In side view the posterior end of the genital segment carries a dorsal pointed spine.

***Corycaeus giesbrechti* F. Dahl**

(Figure 37)

[*Corycaeus giesbrechti* F. Dahl, Verhandl. Deut. zool. Gesellsch., vol. 4, München, p. 72, 1894b.]

Not found in the Atlantic plankton, but present in the southeastern and central regions of the Pacific and even more widely scattered than the two preceding species. It was taken once at the surface in the night, and in the daytime was found in 3 surface tows, 3 50-meter tows, and 2 100-meter tows. The genital and anal segments are slender and each is twice as long as wide; the caudal rami are of the same length as the anal segment.

***Corycaeus lautus* Dana**

[*Corycaeus lautus* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 37, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1219, 1853; pl. 85, fig. 12, 1855.]

Found at the first Atlantic station, at six stations in the Sargasso and Caribbean regions, and in every region of the Pacific except the far north. It was present in 5 nocturnal surface tows, and in the daytime was taken in 19 surface tows, 22 50-meter tows, and 22 100-meter tows; also taken in the vertical tow from 1000 meters at station 64. This is the longest of all the species of the genus, and the genital segment is but little wider than the anal segment.

***Corycaeus limbatus* Brady**

[*Corycaeus limbatus* Brady, Voyage of H.M.S. Challenger, Zool., vol. 8, pt. 23, Copepoda, p. 114, pl. 49, 1883.]

Found at four localities in the Atlantic and fairly abundant in the southeastern Pacific, but very scattering elsewhere. It was taken in 5 nocturnal surface tows, and in the daytime in 19 surface tows, 19 50-meter tows, and 20 100-meter tows, an exceptionally uniform vertical distribution. The urosome is one-segmented in the female, slender and tapered evenly both anteriorly and posteriorly; the terminal claw of the second antenna is exceptionally short. In the male the urosome is two-segmented, the genital segment much wider than the anal segment, the latter abruptly narrowed; the terminal claw of the second antenna is much longer.

***Corycaeus longistylis* Dana**

[*Corycaeus longistylis* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 36, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1212, 1853; pl. 85, fig. 5a-d, 1855.]

Not found in the Atlantic plankton, but common in the southeastern and central regions of the Pacific. It was captured in 2 nocturnal and 25 diurnal surface tows, 33 50-meter tows, and 30 100-meter tows; also in the vertical tow from 1000 meters at station 64. The urosome of the female is two-segmented, the genital segment nearly twice as wide as the anal segment, the latter abruptly narrowed. The posterior processes of the third thoracic segment reach backward beyond the posterior margin of the genital segment.

***Corycaeus lubbockii* Giesbrecht**

(Figure 38)

[*Corycaeus lubbockii* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 481, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 660, 674; pl. 51, figs. 51, 57, 58, 1892.]

Not found in the Atlantic plankton, but present at four stations in the eastern, central, and western parts of the tropical Pacific. It was taken twice in the surface tow, once in the 50-meter tow, and once in the 100-meter tow. In the female there is a small knob on the dorsal surface of the genital segment, and in both sexes the anterior margin of the genital segment carries a small medium spine on the ventral surface.

***Corycaeus minimus* F. Dahl**

(Figure 39)

[*Corycaeus minimus* F. Dahl, Verhandl. Deut. zool. Gesellsch., vol. 4, München, p. 71, 1894b.]

Found at three stations in the Atlantic and two in the southeastern Pacific. It was present three times in the surface tow, once in the 50-meter tow, and twice in the 100-meter tow. This species is very small, the anal segment is nearly as wide as long, and the caudal rami are twice as long as the anal segment.

Corycaeus ovalis Claus

[*Corycaeus ovalis* Claus, Die freilebenden Copepoden, p. 158, 1863.]

Found at station 1 in the Atlantic and in widely separated localities of the southeastern, central, and western Pacific. It was present in 8 surface tows, 7 50-meter tows, and 2 100-meter tows. The posterior processes of the fourth thoracic segment are pointed, and the caudal rami are not longer than the anal segment.

Corycaeus pacificus F. Dahl

[*Corycaeus pacificus* F. Dahl, Verhandl. Deut. zool. Gesellsch., vol. 4, München, p. 73, 1894b.]

Not found in the Atlantic plankton, but very irregularly scattered in the southeastern, central, and western Pacific. It was present in 3 nocturnal and 5 diurnal surface tows, 13 50-meter tows, and 13 100-meter tows. The posterior processes of the fourth thoracic segment are bluntly rounded, sometimes almost circular.

Corycaeus pumilus M. Dahl

[*Corycaeus pumilus* M. Dahl, Ergebn. der Plankton-Exped. der Humboldt-Stiftung, vol. 2, G. f. 1, Die Copepoden, p. 91, pl. 12, figs. 21-28, 1912.]

Found at five Atlantic stations, and well distributed in all regions of the Pacific except the north. Present in 12 nocturnal and 25 diurnal surface tows, 28 50-meter tows, and 25 100-meter tows, another exceptionally even vertical distribution. In the female the metasome is nearly three times as long as the urosome; in the male the cylindrical posterior part of the genital segment is only one-third as long as wide.

Corycaeus robustus Giesbrecht

[*Corycaeus robustus* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 480, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 660, 673; pl. 51, figs. 38, 42, 1892.]

Not found in the Atlantic plankton, and very irregularly scattered over all regions of the Pacific except the north. It was captured in 1 nocturnal and 6 diurnal surface tows, 9 50-meter tows, and 10 100-meter tows. The genital segment is much swollen laterally and notched near the center of each lateral margin. The processes of the fourth thoracic segment are squarely truncated posteriorly, and the anal segment is much wider than long.

Corycaeus speciosus Dana

(Figure 41)

[*Corycaeus speciosus* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 38, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1220, 1853; pl. 86, fig. 1, 1855.]

Found everywhere in both oceans, except in the northern parts and at stations 51 to 64 in the South Pacific. Present in 8 nocturnal and 75 diurnal surface tows, 85 50-meter tows, and 66 100-meter tows. The caudal rami are as long as the

urosome in the male, seven-eighths as long and widely divergent in the female; genital segment of the female usually arched dorsally.

Corycaeus typicus (Krøyer)

[*Agetus typicus* Krøyer, Naturhist. Tidsskr., Kjöbenhavn, ser. 2, vol. 2, p. 603, pl. 6, figs. 27-29, 1849.]

Found in both oceans except in the northern part and the extreme southern part (stations 59 to 61) of the Pacific. Taken in 7 nocturnal and 27 diurnal surface tows, 41 50-meter tows, and 39 100-meter tows. Processes of the fourth thoracic segment standing up vertically and squarely truncated posteriorly, each with a small tooth at the ventral corner.

Genus **DANODES**, new genus

Body short and stout; metasome pear-shaped and three-fourths as wide as long; head fused with the first segment, free thorax strongly tapered posteriorly; urosome much shorter than metasome and relatively narrow.

First antenna eight-segmented and short; second antenna uniramous, four-segmented; mandible with setaceous palp; lobes of first maxilla very unequal in size; second maxilla and maxilliped unguiculate; mouth a short siphon projecting ventrally. First four pairs of legs biramous, with three-segmented rami; fifth legs entirely lacking but each replaced by a single small seta.

This genus belongs to the siphonostomous Cyclopoida, and is distinguished from the other genera in that group by the eight-segmented first antennae, the uniramous second antennae, and the absence of fifth legs. Furthermore, the metasome is not at all depressed and is without epimeral plates.

Genotype. Danodes plumata.

Danodes plumata, new species

(Figures 57-68)

Occurrence. Some thirty specimens, all females, were obtained from eleven stations in the eastern and central Pacific, but the species was not found in the Atlantic. Most of the specimens were captured at the surface, but one was found in a 50-meter tow and a few in 2 100-meter tows.

Description of female. Metasome pyriform and well arched both dorsally and ventrally, two-thirds as wide as long. Head completely fused with the first thoracic segment, the resultant cephalothorax widest considerably behind its center. Free thoracic segments diminishing rapidly in width backward and without epimeral plates, but the fourth segment has bluntly rounded processes at its posterior corners extending backward and slightly overlapping the fifth segment. Urosome five-eighths as long and one-sixth as wide as the metasome, and five-segmented. The fifth thoracic segment is a little more than half the width of the fourth; the anterior part of the genital segment is as wide as the fifth segment, with an oviduct opening on each lateral margin; the posterior part is tapered to the same width as the first abdominal segment, where it joins the latter.

The abdomen is three-segmented, the segments diminishing considerably in length posteriorly, but only slightly in

width. Each of the segments of the urosome carries at each posterior corner a fingerlike process which curves inward and overlaps the segment next behind it. Each caudal ramus is as long as the anal segment and two-thirds as wide as long, with four posterior setae and one on the dorsal surface which is attached to an enlarged and projecting base.

The head has a small knob at the center of the anterior margin, on a level with the dorsal surface, but no actual rostrum. The first antennae are eight-segmented, the basal segment the shortest, the terminal segment the longest. The second, third, and eighth segments carry numerous setae, and the sixth segment has a slender aesthetask which reaches beyond the tip of the antenna. The second antenna is uniramous and four-segmented, the end segment with four setae of which the terminal one is the longest.

The mouth tube is short and curved backward, and stands out nearly at right angles to the ventral surface of the head; it is slightly enlarged at the tip, with a radiating flange. The mandibular palp is setaceous, consisting of a narrow cylindrical joint carrying at its tip a long seta. The first maxilla has the inner lobe well developed and tipped with two stout setae, the outer lobe slightly longer with three setae. The second maxilla and maxilliped are unguiculate; the dactylus of the former is distinctly two-jointed, the terminal part strongly curved and armed on its outer surface at the proximal end with two rows of denticles which join distally and at the point of junction carry a fingerlike process. The dactylus of the maxilliped is triarticulate, the terminal part lightly curved and with a single row of cilia on the ventral surface.

The first four pairs of legs have three-segmented rami with the spines and setae arranged as follows: first exopod 1-0, 1-1, 2-5, endopod 1-1, 0-2, 0-7; second exopod 1-1, 1-1, 3-4, endopod 1-1, 0-2, 0-6; third exopod 0-1, 1-1, 3-3, endopod 1-1, 0-2, 0-5; fourth exopod 0-1, 1-1, 2-3, endopod 1-1, 0-2, 0-4. The fifth legs are entirely lacking, but each is replaced by a small seta just inside the posterior corner of the fifth segment.

Total length, 1.35 (1.25-1.45) mm; length of metasome, 0.80 mm; width, 0.65 mm; length of urosome, 0.55 mm; width, 0.15 mm.

Type. U. S. Nat. Mus. no. 64003.

Remarks. This is evidently a surface copepod, but it occasionally retires to the 50-meter or even the 100-meter level. The suctorial character of the mouth is suited to a more or less parasitic existence, but all the present specimens were taken while free-swimming and there is nothing to indicate the character or identity of a possible host.

Genus DREPANOPUS Brady, 1883

Drepanopus pectinatus Brady

[*Drepanopus pectinatus* Brady, Voyage of H.M.S. Challenger, Zool., vol. 8, pt. 23, Copepoda, p. 77, pl. 24, figs. 1-11, 1883.]

A few specimens, including both sexes, were obtained in the 100-meter tow at station 4 in the northern central Atlantic, and this was the only record for the entire cruise.

Brady's (1883, p. 77) original specimens were taken at Kerguelen Island in the southern Indian Ocean and in the open sea west of it. Giesbrecht (1892, p. 201) reported another species from the South Atlantic and the South Pacific. As far as is known, this is the first record of any species of the genus from the North Atlantic. The species is evidently very rare and is confined to isolated localities.

Genus DYSGAMUS Steenstrup and Lütken, 1861

Dysgamus atlanticus Steenstrup and Lütken

(Figure 32)

[*Dysgamus atlanticus* Steenstrup and Lütken, Kong. Danske Vidensk. Selsk. Skr., ser. 5, Naturhist. og. math. Afd., vol. 5, p. 368, pl. 4, fig. 8, 1861.]

A single male was found in the 100-meter tow at station 156 in the central tropical Pacific, in latitude 3° north. In addition to the original description of the species by Steenstrup and Lütken (1861, p. 368), Lönnberg (1889, p. 150) published a more detailed and accurate account. But neither of these papers contained a figure showing the pattern of the dorsal surface of the metasome, which is of considerable assistance in identifying the species. Since the *Carnegie* specimen showed this pattern rather distinctly, a figure of it is here introduced (fig. 32) for comparison with those of the other two species of the genus already published by the present author (*D. ariommus* Wilson, 1907, p. 713, pl. 20, figs. 62-70; *D. longifurcatus* Wilson, 1923, p. 11, pl. 2, figs. 20-27).

Genus EUAETIDEUS G. O. Sars, 1925

Euaetideus bradyi (A. Scott)

[*Actideus bradyi* A. Scott, Copepoda of the Siboga Exped., vol. 29a, pt. 1, p. 38, pl. 5, figs. 1-12, 1909.]

Four specimens of this species were found in the eastern Pacific, 1 in a nocturnal surface tow, the other 3 in 100-meter tows. These 3 were negative to light, but the 1 shows that it comes to the surface during the night. It is worthy of note that all the 25 specimens recorded as obtained in the *Siboga* plankton were taken in vertical tows from various depths, the minimum being 700 meters. This suggests that the species is a deep-water form that would not be found very often within the upper 100 meters during the daytime.

Euaetideus giesbrechti (Cleve)

[*Actideus giesbrechti* Cleve, Marine Invest. South Africa, vol. 3, pt. 1, Copepoda, p. 185, 1904.]

Not found in the Atlantic plankton, and in the Pacific found chiefly in the eastern and southeastern regions. It was taken in 1 50-meter tow and 9 100-meter tows, but nowhere at the surface either by day or by night. All the specimens of this species in the *Siboga* plankton were taken in vertical tows from considerable depths, with one exception, 5 specimens taken at the surface at night. It is thus strongly negative to light but does come to the surface during the night.

Genus **EUAUGAPTILUS** G. O. Sars, 1920**Euaugaptilus filigerus** (Claus)

[*Hemicalanus filigerus* Claus, Die freilebenden Copepoden, p. 179, 1863.]

A single female was taken in the 100-meter tow at station 55, and this was the only specimen for the entire cruise. The 5 specimens reported by A. Scott (1909, p. 136) from the *Siboga* plankton were each captured in a separate vertical tow from a considerable depth. Hence we may reasonably infer that the species is nowhere abundant and that it is a deep-water form which very seldom comes into the upper 100 meters. The fact that the two abdominal segments and the caudal rami are of the same length will distinguish the species.

Genus **EUCALANUS** Dana, 1853

The species of this genus were widely scattered in both oceans, but the distribution was markedly gregarious, with teeming colonies separated by long intervals of entire absence from the plankton. The species are dispersed over all the oceans, including the Mediterranean, Arctic, and Antarctic, and some of them can be found in every zone, but they are more common in the tropics and southern localities than in the north. They are also present at various depths, from the surface to some of the deepest tows that have been taken.

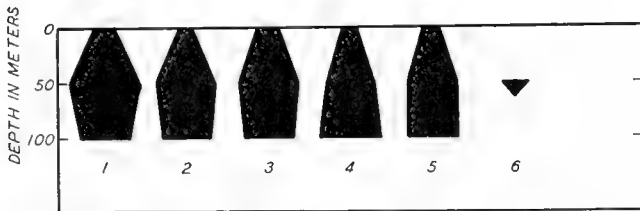


CHART 7. Daytime vertical distribution of species of *Eucalanus*: (1) *attenuatus*, (2) *crassus*, (3) *elongatus*, (4) *monachus*, (5) *mucronatus*, (6) *subtennis*. A single species was confined to the 50-meter tow, and the other five species were each distributed at all three depths but were least abundant at the surface. Three of these five species were most abundant in the 50-meter tow, one was most abundant in the 100-meter tow, and one was equally abundant in the two deeper tows. These records show that each of the species is more or less negative to light and prefers the greater depths in the daytime, one of them not coming to the surface at all.

Eucalanus attenuatus (Dana)

[*Calanus attenuatus* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 18, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1080, 1853; pl. 75, fig. 2a-m, 1855.]

This species was taken once in the Atlantic, and was scattered over the entire Pacific, even in the extreme north, but with one very long gap (stations 46 to 67) in its distribution and many shorter ones. It was present in 14 surface tows, 59 50-meter tows, and 48 100-meter tows. In view of such wide distribution, it seems strange that this species was not found in the plankton of the *Siboga* expedition.

Eucalanus crassus Giesbrecht

[*Eucalanus crassus* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 333, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 132, 151, pl. 4, fig. 9; pl. 11, figs. 8, 10, 15, 17, 21, 22, 29, 33, 35, 38; pl. 35, figs. 4, 20, 26-28, 1892.]

Not present in the Atlantic plankton, and showing in the Pacific a similar long gap from station 45 to 68, though present at stations 55, 57, and 64(b), and another gap from station 134 to 160. It was taken in 2 nocturnal and 3 diurnal surface tows, 25 50-meter tows, and 22 100-meter tows, and in the vertical tow from 1000 meters at station 64. It can be identified by the very swollen, almost spherical genital segment.

Eucalanus elongatus (Dana)

[*Calanus elongatus* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 18, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1079, 1853; pl. 74, fig. 10, 1855.]

Widely scattered in both oceans but quite straggling both in abundance and in continuity of distribution. It was present in 2 nocturnal and 10 diurnal surface tows, 69 50-meter tows, and 62 100-meter tows, and in the vertical tow from 1000 meters at station 64. It is the only species in which the urosome is four-segmented, and often attains a large size.

Eucalanus monachus Giesbrecht

[*Eucalanus monachus* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 333, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 132, 151, pl. 11, fig. 37; pl. 35, figs. 5, 14, 33, 36, 1892.]

Not obtained in the Atlantic plankton, common in the eastern tropical Pacific (stations 35 to 47 and 71 to 75), but found only three times elsewhere. It was present in 2 nocturnal and 6 diurnal surface tows, 17 50-meter tows, and 19 100-meter tows. It is considerably shorter than the preceding species and the genital segment is wider than long.

Eucalanus mucronatus Giesbrecht

[*Eucalanus mucronatus* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 334, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 132, 151, pl. 11, figs. 9, 26, 34; pl. 35, figs. 15, 35, 38, 1892.]

Not present in the Atlantic plankton, and in the Pacific virtually limited to the eastern tropical region. It was taken in 2 surface tows, 8 50-meter tows, 8 100-meter tows, and in the vertical tow from 1000 meters at station 64. It is easily recognized by the hooklike projection on the forehead, but this is sometimes concealed by being telescoped into the head.

Eucalanus subtennis Giesbrecht

[*Eucalanus subtennis* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 333, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 132, 150, pl. 11, figs. 23, 42; pl. 35, figs. 9-11, 18, 29, 30, 1892.]

Not present in the Atlantic plankton, and found at only six widely separated stations in the Pacific. At each of these

stations it was confined to the 50-meter tow and barely 2 or 3 specimens were obtained. This is much smaller than the preceding species, and in the male only the left fifth leg is present. In the female the setae of the caudal rami are asymmetrical, being longer and thicker on the right side.

Genus **EUCHAETA** Philippi, 1843

Euchaeta acuta Giesbrecht

[*Euchaeta acuta* Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, pp. 246, 262, pl. 16, figs. 6, 10, 14, 18, 21, 27, 39; pl. 37, figs. 47, 48, 52, 1892.]

Not found in Atlantic plankton, and although it was widely scattered in the Pacific there are numerous large gaps in its distribution. It was present in 5 nocturnal and 4 diurnal surface tows, 25 50-meter tows, and 35 100-meter tows; also in the vertical tow from 1000 meters at station 64. The left side of the genital segment has an anterior blunt process, which is distinctly notched in dorsal view.

Euchaeta hebes Giesbrecht

[*Euchaeta hebes* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 337, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 246, 263, pl. 15, figs. 29, 30; pl. 16, figs. 3-5, 20, 31, 32, 38, 44; pl. 37, figs. 32, 33, 54, 1892.]

Three specimens of this species were obtained in the 100-meter tow at station 35 off the Pacific end of the Panama Canal, and it was found nowhere else in either ocean. As far as is known, this is the first record of the species from the Pacific Ocean.

Euchaeta marina (Prestandrea)

[*Cyclops marinus* Prestandrea, Effemeridi sci. e lett. Sicilia, vol. 6, p. 12, 1833.]

This is the most widely distributed species of the genus, and was found everywhere in both oceans except the northern and southern regions of the Pacific (stations 57 to 68 and 115 to 129). It was present in 10 nocturnal and 38 diurnal surface tows, 87 50-meter tows, and 82 100-meter tows. It was often found equally distributed in all three tows at the same time. Both the last thoracic and the genital segment are asymmetrical in the female, the right side being the larger.

Euchaeta spinosa Giesbrecht

[*Euchaeta spinosa* Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, pp. 246, 263, pl. 16, figs. 26, 34, 47; pl. 37, figs. 31, 34, 50, 1892.]

One specimen was taken in a nocturnal surface tow between stations 63 and 64 in the southeastern Pacific and a few specimens were found in the vertical tow from a depth of 1000 meters at station 64. The former indicates that it does migrate to the surface in the night, and the latter suggests that it remains below 100 meters in the daytime, since it did not appear in the regular tows at station 64. It has been reported by Esterly (1905, p. 159) from the San Diego region, California, by Sharpe (1910, p. 410) from the Cape Cod region on the Atlantic coast, and by other authors

from the Mediterranean, Atlantic, Pacific, and Indian oceans. In view of such a wide distribution, it is worthy of note that it did not appear in either the *Challenger* or the *Siboga* plankton.

Genus **EUCHAETOPSIS?** Brady, 1918

Euchaetopsis? species

It is with utmost hesitation that two very juvenile copepods from Atlantic station 1 are considered as possibly representing this genus. The genus is monotypic; only the female of *Euchaetopsis haswelli* Brady, from the Antarctic Ocean, is known.

Genus **EUCHIRELLA** Giesbrecht, 1888

Euchirella brevis G. O. Sars

[*Euchirella brevis* G. O. Sars, Bull. Mus. océanogr. Monaco, no. 26, p. 12, 1905.]

Found in the Sargasso and Caribbean regions and scattered very irregularly over the entire Pacific with few records at consecutive stations. It was taken in 2 nocturnal and 2 diurnal surface tows, 31 50-meter tows, and 25 100-meter tows. The setae on the enlarged exopod of the second antennae were often exceptionally long, densely plumose, and bright red. These records show the species to be negative to light, with a slight preference for the 50-meter tow.

Euchirella curticauda Giesbrecht

[*Euchirella curticauda* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 336, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 233, 244, pl. 15, figs. 3, 13, 25; pl. 36, figs. 19, 20, 1892.]

Found at the first station in the Atlantic and at many stations in the Pacific, long distances apart except in the central region. It was taken in 4 surface tows, 23 50-meter tows, and 11 100-meter tows. The first basipod of the fourth legs has a row of nine to thirteen teeth on its inner margin, and the forehead has a high crest. This species is also negative to light, with more of a preference for the 50-meter tow, and it did not appear in any nocturnal tow.

Euchirella intermedia With

[*Euchirella intermedia* With, Copepoda of the Danish Ingolf-Exped., vol. 3, no. 4, p. 124, 1915.]

Nine specimens were taken at five Pacific stations, 1 in the 50-meter tow, 5 in the 100-meter tow, and 3 in the vertical tow from 1000 meters at station 64. This species does not have a crest, and there is a single long, slender spine on the posterior surface of the first basipod of the fourth leg. Its entire absence from the surface tows, both nocturnal and diurnal, shows it to be more negative to light than either of the preceding species.

Euchirella messinensis (Claus)

[*Undina messinensis* Claus, Die freilebenden Copepoden, p. 187, 1863.]

This species was not present in the Atlantic plankton, and in the Pacific was found once in a 50-meter tow, once in a

100-meter tow, and in the vertical tow from a depth of 1000 meters at station 64. The genital segment of the female is asymmetrical, with a posterior outgrowth on the left side. The first basipod of each fourth leg has two small spines on the inner margin.

Euchirella pulchra (Lubbock)

[*Undina pulchra* Lubbock, Trans. Entomol. Soc. London, n. s., vol. 4, pt. 1, p. 20, 1856.]

Found at stations 1 and 27 in the Atlantic and in every region of the Pacific except the north, but at widely separated localities. Taken twice in the surface tow, 7 times in the 50-meter tow, and 7 times in the 100-meter tow. Nine of these records were single specimens and four others were numerals; these correspond well to A. Scott's (1909, p. 56) records of the *Siboga* plankton, the largest of which was 6 specimens. These few records indicate that it is more or less negative to light.

Euchirella rostrata (Claus)

[*Undina rostrata* Claus, Die Copepoden-Fauna von Nizza, p. 11, pl. 1, fig. 10, 1866.]

Found at four stations in the Atlantic, two of which were in the far north, and at six stations in the southeastern Pacific. Taken 5 times in the 50-meter tow, 5 times in the 100-meter tow, and once in the vertical tow from 1000 meters, station 64, but not at all at the surface. Eight of these records consisted of numerals and the other three were designated as rare (*r*). As far as they go, they indicate a negative phototropism for the species, with limited nocturnal migration.

Genus EUTERPINA Norman, 1903

Euterpina acutifrons (Dana)

[*Harpacticus acutifrons* Dana, Proc. Amer. Acad. Arts and Sci., vol. 1, p. 153, 1847; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1192, 1853; pl. 83, fig. 11a, b, 1855.]

Not present in the Atlantic plankton, but found at four stations in the southeastern Pacific. It was taken once in the surface tow, 3 times in the 50-meter tow, and 3 times in the 100-meter tow. Four of these records were single specimens, two more were 2 specimens each, and the seventh was 4 specimens. This harpacticid is probably negative to strong light. This species has been reported by Cleve (1900-1901, p. 143; 1900a, p. 7; 1900b, p. 65; as *Euterpe acutifrons*) from both the North and South Atlantic, and by Esterly (1905, p. 212) as abundant in the Pacific in the San Diego region, California. It was also reported by Sewell (1924, p. 836) from Chilka Lake, a brackish lagoon on the west coast of British India, so that it is not wholly pelagic.

Genus FARRANULA (Blake MS) Wilson, 1932b

The generic name *Corycella* proposed by Farran (1911, p. 284) for these small cyclopids had been preoccupied by Léger in 1892 for a genus of Protozoa, and Charles H. Blake

suggested in manuscript the name *Farranula* in place of it. This was adopted and published by the present author (1932b, p. 594, footnote).

This is essentially a tropical genus, and is widely distributed over the warmer regions of all oceans between latitudes 40° north and 40° south. The species belonging to the genus are among the smallest copepods known, less than a millimeter in length, but they make up in numbers what they lack in size, and often constituted the bulk of the surface copepod plankton.

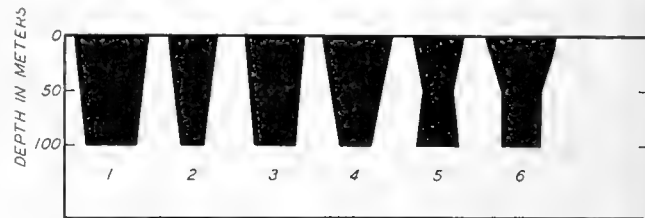


CHART 8. Daytime vertical distribution of species of *Farranula*: (1) *carinata*, (2) *concinna*, (3) *curta*, (4) *gibbula*, (5) *gracilis*, (6) *rostrata*. Five species were found somewhat more often at the surface, less often in the 50-meter tow, and least often in the 100-meter tow. The sixth species was found least often in the 50-meter tow, more often in the 100-meter tow, and most often at the surface. According to these *Carnegie* records, therefore, the species were all positive to light, but the attraction was very weak. The differences in the number of times each species was present, and in its relative abundance, at the three depths were very small. The two most abundant species frequently showed no differences at all in vertical distribution.

Farranula carinata (Giesbrecht)

[*Corycaeus carinatus* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 481, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 661, 675, pl. 50, fig. 20, 1892.]

The gaps in the distribution of this species were from station 6 to 13 in the North Atlantic, 42 to 45 in the eastern Pacific, 58 to 61 in the South Pacific, and 115 to 128 in the North Pacific. It was taken in 21 nocturnal and 100 diurnal surface tows, 86 50-meter tows, and 72 100-meter tows. It was repeatedly found in two of the tows and often in all three at the same station, and more or less equally distributed. It was recorded as abundant more than a hundred times, and surpassed any other single species of the genus in the number of specimens obtained.

Farranula concinna (Dana)

(Figure 33)

[*Corycaeus concinnus* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 39, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1225, 1853; pl. 86, fig. 7a, b, 1855.]

Not present in the Atlantic plankton; in the Pacific it was taken in 8 nocturnal and 10 diurnal surface tows, 6 50-meter tows, and 5 100-meter tows. It was recorded but once as abundant and five times as common. Nearly all the speci-

mens of this species obtained in the *Siboga* plankton were taken in vertical hauls from considerable depths.

Farranula curta (Farran)

[*Corycella curta* Farran, Proc. Zool. Soc. London, 1911, p. 286, pl. 10, figs. 7-11; pl. 11, figs. 1-6, 1911.]

Found at four Atlantic localities and fairly common in the southeastern and central Pacific. It was present in 17 nocturnal and 21 diurnal surface tows, 18 50-meter tows, and 17 100-meter tows. It was recorded twelve times as abundant and twelve times as common. The species has been recorded previously from the Indian and Pacific oceans, but not from the Atlantic.

Farranula gibbula (Giesbrecht)

(Figure 35)

[*Corycaeus gibbula* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 481, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 661, 675, 1892.]

Not found in the North Atlantic (stations 6 to 14), in the South Pacific (stations 58 to 60), in the eastern tropical Pacific (stations 70 to 76), and in the North Pacific (stations 118 to 128), but present everywhere else. It was taken in 22 nocturnal and 76 diurnal surface tows, 41 50-meter tows, and 29 100-meter tows. It was recorded twenty-one times as abundant and thirty-eight times as common. As far as is known, the species is here reported from the Atlantic for the first time.

Farranula gracilis (Dana)

(Figure 34)

[*Corycaeus gracilis* Dana, U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1207, 1853; pl. 85, fig. 1a-d, 1855.]

Found at three Atlantic localities, and in the Pacific chiefly confined to the southeastern region. It was present in 13 nocturnal and 21 diurnal surface tows, 11 50-meter tows, and 14 100-meter tows. It was recorded three times as abundant and nine times as common, but on the other hand twenty records were numerals. Farran (1929, p. 296) has reported it as common in the tropical and north temperate Atlantic as well as in the South Pacific.

Farranula rostrata (Claus)

[*Corycaeus rostratus* Claus, Die freilebenden Copepoden, p. 157, pl. 28, 1863.]

This was the most abundant species next to *carinata*, and was present in both oceans except in the far north and all but two stations in the extreme south. It was taken in 32 nocturnal and 79 diurnal surface tows, 61 50-meter tows, and 61 100-meter tows. It was recorded forty-five times as abundant and sixty-eight times as common. Like *carinata*, this species was repeatedly found equally distributed in two or even all three tows at the same time. It was reported by Farran (1929, p. 297) as scarce in the Atlantic but common off New Zealand in the South Pacific.

Genus **GAETANUS** Giesbrecht, 1888

Gaetanus armiger Giesbrecht

[*Gaetanus armiger* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 335, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 219, 224, pl. 14, figs. 19, 22, 26, 28, 29; pl. 36, figs. 2, 4, 1892.]

Found only in the Pacific, at station 35 in the 100-meter tow and at station 64 in the vertical tow from a depth of 1000 meters. In the former a single specimen and in the latter 4 specimens were obtained. This suggests that the species may have been present in other localities but that the regular tows were not deep enough to reach it. However, one of the two specimens obtained in the *Siboga* plankton was captured at the surface in the daytime.

Gaetanus kruppilii Giesbrecht

[*Gaetanus kruppilii* Giesbrecht, Mittheil. aus der Zool. Stat. zu Neapel, vol. 16, p. 202, pls. 7, 8, 1903.]

The identification of the single immature male from the vertical tow from 1000 meters at Pacific station 64 off the coast of Chile (latitude 31° 54' south, longitude 88° 17' west) should perhaps be considered provisional. From the manner in which the haul was made, it is impossible to say at which level the specimen was captured between 1000 meters and the surface. Otherwise, this species has previously been recorded from the North and South Atlantic, the Mediterranean, and the Indian Ocean.

Gaetanus latifrons G. O. Sars

[*Gaetanus latifrons* G. O. Sars, Bull. Mus. océanogr. Monaco, no. 26, p. 11, 1905.]

A single female was obtained in the 100-meter tow at station 137, and this was the only record for the cruise. The fact that only a single specimen of this species was found in the *Siboga* plankton, although the majority of the tows started well below 100 meters, would suggest that the species is not abundant anywhere or at any depth. Sars (1925, p. 57) and With (1915, p. 108) have both recorded this species from the North Atlantic as well as from the Pacific Ocean.

Gaetanus miles Giesbrecht

[*Gaetanus miles* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 335, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 219, 224, pl. 14, figs. 21, 24, 25, 27, 30; pl. 36, figs. 1, 3, 1892.]

Found at three widely separated Pacific stations, in the 100-meter tow at stations 37 and 152 and in the vertical tow from 1000 meters at station 64. As suggested for *armiger*, this species may have been present elsewhere below the regular tows, as it is known to be well distributed in both oceans. It is easily recognized by the spine on the forehead and the exceptional length of the first antennae. It has also been reported by Sars (1925, p. 54) and With (1915, p. 107) from the North Atlantic, and by Cleve (1904, p. 191) from the South Atlantic.

Gaetanus minor Farran

[*Gaetanus minor* Farran, Ann. Rept. Fisheries, Ireland, 1902-03, pt. 2, app. 2, p. 34, pl. 5, figs. 1-11, 1905.]

This species was taken in a nocturnal surface tow between stations 35 and 36 and in the vertical tow from a depth of 1000 meters at station 64. The former proves that the species migrates to the surface in the night; the latter suggests that the regular tows were not deep enough for this species in the daytime. In support of the latter suggestion, all the *Siboga* specimens were taken in vertical hauls from considerable depths.

Genus **GAIIDIUS** Giesbrecht, 1895**Gaidius affinis** G. O. Sars

[*Gaidius affinis* G. O. Sars, Bull. Mus. océanogr. Monaco, no. 26, p. 9, 1905.]

One specimen of this species was found in the vertical tow from 1000 meters at station 64 in the southeastern Pacific. It is smaller than *brevispinus* but larger than *tenuispinus*. It is probably more widely distributed than this single locality would indicate, but stays below 100 meters in the daytime. Sars (1905, p. 9; 1925, p. 47) reported this species from both the Atlantic and the Pacific oceans in vertical hauls from depths of 1500 to 4800 meters.

Gaidius brevispinus G. O. Sars

[*Gaidius brevispinus* G. O. Sars, Norwegian North Polar Exped., 1893-1896, Sci. res., vol. 5, Crustacea, p. 68, pl. 19, 1900.]

A few specimens were found in the 100-meter tow at station 8 in the Atlantic, and the species was found nowhere else during the cruise. This is a boreal species, and has been reported from the Arctic Ocean and the North Atlantic. All Sars' (1903, p. 162; 1925, p. 48) specimens were taken in vertical hauls from depths of 1700 to 2000 meters.

Gaidius tenuispinus (G. O. Sars)

[*Chinidius tenuispinus* G. O. Sars, Norwegian North Polar Exped., 1893-1896, Sci. res., vol. 5, Crustacea, p. 67, pl. 18, 1900.]

This species was found in the southeastern and northern parts of the Pacific. It was taken twice in the 50-meter tow, 5 times in the 100-meter tow, and once in the vertical tow from 1000 meters at station 64. The records are all expressed in numerals, indicating that the species is nowhere abundant. Since it did not occur anywhere at the surface, it is evidently negative to light. It was reported by Sars (1903, p. 162; 1925, p. 46) from several localities in the North Atlantic and even in the Arctic Ocean, and is a boreal form.

Genus **HALOPTILUS** Giesbrecht, 1898

This genus was well scattered over both oceans, but showed several large gaps in distribution. No species was found in the first thirteen stations of the Atlantic, or at stations 58 to 68 in the Pacific (except at station 67 and in the 1000-meter haul at station 64), or at stations 82 to 93 and

117 to 130. All the species, without exception, were confined to the two deeper tows, especially the 100-meter tow. The fact that no species of this genus appeared in any of the nocturnal surface tows would suggest that the genus does not take part very often in the vertical migrations.

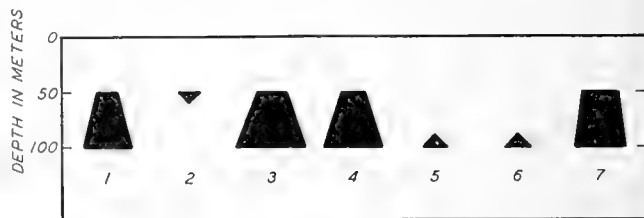


CHART 9. Daytime vertical distribution of species of *Haloptilus*: (1) *acutifrons*, (2) *angusticeps*, (3) *longicornis*, (4) *ornatus*, (5) *oxycephalus*, (6) *plumosus*, (7) *spiniceps*. One species was confined to the 50-meter tow, two to the 100-meter tow, and the other four appeared only in the two deeper tows, with the greater abundance in the 100-meter tow. This is a more uniform vertical distribution than that of some of the other genera, and all the species react similarly to their environment.

Haloptilus acutifrons (Giesbrecht)

[*Hemicalanus acutifrons* Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, pp. 384, 398, pl. 3, fig. 11; pl. 27, figs. 4, 12, 18, 26; pl. 42, figs. 12, 20, 1892.]

This species was present in 3 50-meter tows and in 14 100-meter tows, and in the vertical tow from 1000 meters at station 64, all in the Pacific Ocean. With a single exception, every one of the abundance records is a numeral, and twelve of them were single specimens. In this connection it is worthy of note that the species did not appear at all in the *Siboga* plankton or in the *Ingolf* plankton. Its scarcity in the *Carnegie* plankton, therefore, can hardly be due to the fact that the tows (with one exception) did not descend below 100 meters. It has been recorded by Sars (1925, p. 250) and Farran (1929, p. 267) from the North Atlantic and the Arctic Ocean.

Haloptilus angusticeps G. O. Sars

[*Haloptilus angusticeps* G. O. Sars, Bull. Inst. océanogr. Monaco, no. 101, p. 20, 1907.]

A single female was taken in the 50-meter tow at station 116 in the western Pacific off the coast of Japan, and this was the only record for the cruise. Like the preceding species, this one did not appear in the lists of any of the plankton expeditions, but has been reported by Sars (1925, p. 246) from the North Atlantic and the Mediterranean. The species is thus very rare, and this *Carnegie* record is the first one from the Pacific Ocean.

Haloptilus longicornis (Claus)

[*Hemicalanus longicornis* Claus, Die freilebenden Copepoden, p. 179, pl. 29, 1863.]

This is the most numerous and widely distributed species of the genus, and was found everywhere in the temperate and tropical regions of both oceans. It was present in 23 50-

meter tows, 70 100-meter tows, and the vertical tow from 1000 meters at station 64, but not in any of the surface tows. The distal half of each first antenna is very slender and looks fragile, but it must be exceptionally tough, since it usually remains intact in the preserved specimens although the two antennae are often intricately entangled with each other and with the other appendages. The absence of the species from all nocturnal surface tows indicates that it does not take part very often in the upward migration at night. The northern boundary of the species as given by Giesbrecht (1892, p. 384) and Sars (1925, p. 240) (latitude 26° north) is extended by these *Carnegie* records to latitude 34° north in the Pacific and to 42° north in the Atlantic.

Haloptilus ornatus (Giesbrecht)

[*Hemicalanus ornatus* Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, pp. 384, 399, pl. 27, figs. 16, 17, 25; pl. 42, figs. 2, 27, 28, 1892.]

This species was found at nine Atlantic and nine Pacific stations, the Atlantic localities being in the Sargasso and Caribbean regions, the Pacific localities widely scattered. It was present in 4 50-meter tows and 14 100-meter tows, and was recorded as common five times. It was originally taken in the Mediterranean, but has been reported by several authors from the Atlantic and Pacific oceans. Only 2 specimens were obtained in the *Siboga* plankton, both in vertical hauls from depths of 700 to 900 meters.

Haloptilus oxycephalus (Giesbrecht)

[*Hemicalanus oxycephalus* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 1, p. 813, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 384, 398, pl. 42, figs. 7, 16, 23, 1892.]

A single specimen of this species was found in the 100-meter tow at each of two stations, 70 and 74, in the eastern tropical Pacific, and it has also been reported from the tropical Pacific by Giesbrecht (1892, p. 384). Yet Farran (1929, p. 268) has recorded it from both sides of the Antarctic Circle in the South Pacific, so that it cannot be considered as exclusively tropical. Nearly all the specimens previously obtained were taken in vertical hauls from deep water, and the species was nowhere abundant.

Haloptilus plumosus (Claus)

[*Hemicalanus plumosus* Claus, Die freilebenden Copepoden, p. 178, pl. 28, fig. 12; pl. 29, figs. 4-7, 1863.]

This species was found at one Atlantic station and at eighteen widely separated Pacific stations, and in them was strictly confined to the 100-meter tow, though present in the vertical tow from 1000 meters at station 64. Its failure to appear above the 100-meter level suggests that it is bathypelagic, and this conclusion is supported by the fact that all the specimens previously reported have been captured at a depth varying from 400 to 3000 meters. As far as all the records show, these 100-meter tows are the nearest to the surface it has ever been taken.

Haloptilus spiniceps (Giesbrecht)

[*Hemicalanus spiniceps* Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, pp. 384, 399, pl. 27, figs. 5, 20, 35, 40; pl. 42, figs. 3, 8, 10, 11, 21, 25, 1892.]

This species, like *plumosus*, was found at a single Atlantic station and at widely separated localities in the Pacific. It was taken in 13 50-meter tows and 16 100-meter tows, but 80 per cent of the abundance records were numerals. Hence, although fairly widespread, the species is nowhere abundant, and its complete absence from the surface at night as well as in the daytime indicates infrequent nocturnal migrations. The characteristic spiny projection from the forehead is often found telescoped into the head in preserved material, making the identification of the species difficult.

Genus *HETERAMALLA* G. O. Sars, 1907

Heteramalla dubia (T. Scott)

[*Amallophora dubia* T. Scott, Trans. Linn. Soc. London, ser. 2, Zool., vol. 6, pt. 1, p. 55, pl. 4, figs. 1-18, 1894.]

A few specimens were obtained in the 100-meter tows at stations 56 and 153 in the southeastern and central Pacific, and these were the only localities during the cruise. The species was originally reported by T. Scott (1894, p. 55) from the Gulf of Guinea and included males only. A female was afterward found in the *Siboga* plankton and described by A. Scott (1909, p. 86), and both sexes were captured in the North Atlantic during the Monaco expeditions and described by Sars (1925, p. 142). All these specimens were taken in vertical hauls from depths of 1500 to 5000 meters.

Genus *HETERORHABDUS* Giesbrecht, 1898

This is a deep-water genus, and with a single exception none of its species was found at the surface, whereas two of them were confined to the single 1000-meter haul at station 64. The genus was fairly well distributed in both oceans, however, especially in the Pacific, a fact which is the more noteworthy in that most of the specimens hitherto reported came from depths considerably below 100 meters. It belongs chiefly to the temperate and tropical zones, although specimens have been obtained from both polar oceans. The single specimen of the species *papilliger* taken in a nocturnal surface tow indicates very meager participation in the upward migrations at night. The genus may be easily recognized by the asymmetry of the caudal rami and the excessive length of one seta on the left ramus.

Heterorhabdus abyssalis (Giesbrecht)

[*Heterochaeta abyssalis* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 1, p. 812, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 373, 382, pl. 19, fig. 4; pl. 20, figs. 29, 30, 1892.]

Three specimens were taken in the vertical tow from 1000 meters at station 64. This species has been obtained only from considerable depths, as its name implies, and hence it would not be likely to occur in the *Carnegie* plankton except

in this one deep tow. It has been reported by Cleve (1904, p. 191) from the South Atlantic, but Giesbrecht's (1898, p. 116) record from the North Atlantic can hardly be accepted.

Heterorhabdus compactus G. O. Sars

[*Heterorhabdus compactus* G. O. Sars, Rés. camp. sci. Albert de Monaco, no. 69, p. 226, 1925; pl. 62, figs. 1-8, 1924.]

A single female of this species was captured in the vertical tow from 1000 meters at station 64. Farran (1929, p. 267) has recorded this species from two deep vertical tows in the Antarctic south of the Pacific. This deep tow at station 64 came out of the Peruvian or Antarctic current, where the temperature was only 3.8° C at 1000 meters depth. All the specimens obtained by Sars (1925, p. 226) were taken in vertical hauls from depths of 1500 to 4000 meters.

Heterorhabdus norvegicus (Boeck)

[*Heterochaeta norvegica* Boeck, Forhandl. Vidensk. Selsk. Christiania, vol. 14, p. 40, 1872.]

Not present in the Pacific plankton; a few specimens, including both sexes, were taken in the 50-meter tow at station 11 in the North Atlantic. It was recorded by Sars (1900, p. 79; 1902, p. 118; 1925, p. 226) from Nansen's polar expedition and from Greenland, and is evidently a boreal species. In the open ocean it would probably stay well below 100 meters and hence escape the *Carnegie* tows. This is one of the largest species of the genus, and its size aids materially in its identification.

Heterorhabdus papilliger (Claus)

(Figure 56)

[*Heterochaeta papilligera* Claus, Die freilebenden Copepoden, p. 182, pl. 32, 1863.]

This is the most abundant species of the genus; it was found at three of the Atlantic stations and in all the regions of the Pacific, except far north. But a large majority (46) of the abundance records were numerals, hence it was nowhere at all common. It was present in 4 diurnal surface tows, 15 50-meter tows, and 42 100-meter tows, and 1 specimen in the vertical tow from 1000 meters at station 64. It is probably negative to strong light. It was also taken in one of the nocturnal surface tows, and therefore sometimes migrates to the surface at night. The blunt papilla on the forehead and the fifth legs of the male are distinguishing characters. Farran (1929, p. 265) said this was the most frequent species of the genus in the *Terra Nova* plankton.

Heterorhabdus spinifrons (Claus)

[*Heterochaeta spinifrons* Claus, Die freilebenden Copepoden, p. 183, pl. 32, 1863.]

This species was second in abundance; it was not present in the Atlantic plankton and was most frequent in the southeastern and central regions of the Pacific. It was taken in 6 50-meter tows and 18 100-meter tows, but did not appear at the surface. The papilla on the forehead is produced into a sharp point or spine, which distinguishes it from the other species. This is another of the larger species,

and was taken at the surface off New Zealand in the southern Pacific by the *Terra Nova* expedition.

Genus **HETEROSTYLITES** G. O. Sars, 1920

Heterostylites longicornis (Giesbrecht)

[*Heterochaeta longicornis* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 1, p. 812, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 373, 383, pl. 19, fig. 7; pl. 20, figs. 14, 21, 25, 26; pl. 39, fig. 44, 1892.]

This species was not present in the Atlantic plankton and was found but once (station 132) outside the southeastern Pacific. A solitary specimen was taken in a 50-meter tow; all the others were taken in 100-meter tows, except 1 specimen in the vertical tow from 1000 meters, station 64, hence the species is negative to light. The first antennae reach eight or ten segments beyond the tips of the caudal rami and thus identify the species. The species has been reported from the temperate and tropical Atlantic by Giesbrecht (1898, p. 116) and Sars (1925, p. 238).

Genus **LABIDOCERA** Lubbock, 1853

This is a tropical and temperate genus, and was not found north of latitude 50° north in the Atlantic or 40° in the Pacific, nor south of latitude 35° south in the Pacific. It is also a surface genus, and all the species were found either entirely or almost entirely in the surface tow. The species *detruncata* was the only one at all widely distributed, all the others being very local in occurrence.

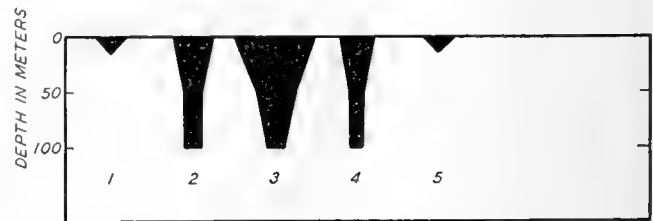


CHART 10. Daytime vertical distribution of species of *Labidocera*: (1) *acuta*, (2) *acutifrons*, (3) *detruncata*, (4) *nerii*, (5) *wollastoni*. Two of the species were confined to the surface; the other three appeared at all three depths but were much more abundant at the surface. This diversity in vertical distribution leads to the conclusion that the positive phototropism of species 1 and 5 is considerably stronger than that of the other three species. In these three species, furthermore, the difference in phototropism is greater in the upper 50 meters than it is between 50 and 100 meters. Attention should be called, however, to the fact that the labidoceran plankton at the surface usually contained a large number of developmental stages, whose reaction to light might change materially on reaching maturity.

Labidocera acuta (Dana)

(Figure 51)

[*Pontella acuta* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 30, 1849.]

[*Pontellina acuta* Dana, U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, pp. 1150-1152, 1853; pl. 80, fig. 12a-c, 1855.]

Not present in the Atlantic plankton, although it was reported from both the North and South Atlantic by Gies-

brecht (1898, p. 135). It was taken in 4 nocturnal and 2 diurnal surface tows in the southeastern Pacific, and apparently stays at the surface throughout the entire 24 hours. Head with median crista which is curved anteriorly into a hook; abdomen and caudal rami symmetrical. It was found in more than fifty of the *Siboga* plankton collections, in one of which the number of specimens obtained was 200 and in another 440, showing that this species, like *detruncata*, is more or less gregarious.

Labidocera acutifrons (Dana)

(Figure 52)

[*Pontella acutifrons* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 30, 1849.]

[*Pontellina acutifrons* Dana, U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, pp. 1149, 1150, 1853; pl. 80, fig. 11a-h, 1855.]

Not present in the Atlantic plankton, but found in the southeastern and central Pacific. Taken in 7 diurnal surface tows, 1 50-meter tow, and 1 100-meter tow, also recorded as common in one of the nocturnal surface tows. Head with a median crista which is not hooked; abdomen and caudal rami quite asymmetrical. This species has been reported from the tropical and temperate Atlantic, both north and south of the equator, by Giesbrecht (1892, p. 445) and Sars (1925, p. 354).

Labidocera detruncata (Dana)

(Figures 53, 69)

[*Pontella detruncata* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 29, 1849.]

[*Pontellina detruncata* Dana, U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, pp. 1143-1145, 1853; pl. 80, fig. 7a-i, 1855.]

Not found in the Atlantic plankton, but the most abundant species of the genus in the Pacific, and found everywhere except in the northern and southern parts, stations 52 to 70 and 116 to 128. It was taken in 6 nocturnal and 68 diurnal surface tows, 11 50-meter tows, and 7 100-meter tows. It is a surface species, and both adults and development stages often swarm at the surface and constitute the bulk of the surface copepods. The females are easily identified by the peculiar asymmetry of the urosome and the males by the structure of the fifth legs. It was reported by Brady (1883, p. 90) from both the North and South Atlantic.

Labidocera nerii (Krøyer)

(Figure 86)

[*Pontia nerii* Krøyer, Naturhist. Tidsskr., Kjöbenhavn, ser. 2, vol. 2, p. 600, 1849.]

Found at four stations in the Atlantic and three in the Pacific, all widely separated. It was present in 4 surface tows, 2 50-meter tows, and 2 100-meter tows. It can be distinguished from the other species by the structure of the fifth legs. As far as is known, this is the first record of the species from the Pacific Ocean, the four stations being in the tropics.

Labidocera wollastoni (Lubbock)

(Figure 95)

[*Pontella wollastoni* Lubbock, Ann. and Mag. Nat. Hist., ser. 2, vol. 20, p. 406, pls. 10, 11, 1857.]

Not present in the Pacific plankton, but taken at two of the Atlantic localities in the surface tow. The specimens were not fully developed, but the fifth legs showed the distinctive structure of this species. Apparently it has never been reported from the Pacific Ocean.

Genus **LOPHOTHRIX** Giesbrecht, 1895

Lophothrix frontalis Giesbrecht

[*Lophothrix frontalis* Giesbrecht, Bull. Mus. Comp. Zoöl., Harvard Coll., vol. 25, no. 12, p. 254, pl. 2, figs. 1-5, 9-12, 1895.]

A single specimen was captured in the vertical tow from 1000 meters at station 64. This is a deep-water species and probably has a much wider distribution than the solitary capture would suggest, since this was the only time the tow nets went below 100 meters. The prominent median crest on the forehead and the structure of the fifth legs identify the species. It was reported as common in deep hauls off the California coast by Esterly (1906, p. 65).

Lophothrix humilifrons G. O. Sars

[*Lophothrix humilifrons* G. O. Sars, Bull. Mus. océanogr. Monaco, no. 26, p. 22, 1905.]

A single specimen was captured in the same vertical tow as the preceding species. This is another deep-water form and, like *frontalis*, is probably more widely distributed at depths below 100 meters. It can be distinguished by its obtusely rounded forehead, which shows no trace of a median crest. This species has been reported only by Sars (1925, p. 166), who found it common in deep hauls in the temperate Atlantic.

Genus **LUBBOCKIA** Claus, 1863

Lubbockia aculeata Giesbrecht

[*Lubbockia aculeata* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 477, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 606, 611, pl. 48, figs. 3, 9, 13, 17, 20, 1892.]

Found at a single station (15) in the Atlantic and at twenty-one widely separated localities in the Pacific. It was taken in 1 nocturnal surface tow, 13 diurnal 50-meter tows, and 15 100-meter tows. It was not present at the surface in the daytime and is therefore negative to light, but migrates to the surface sometimes at night. This species is longer and more slender than *squillimana*, and the posterior margins of the urosome segments are fringed with small spines. All but 2 of the specimens taken in the *Siboga* plankton were captured in vertical hauls from depths of 900 to 1500 meters, and Wolfenden's (1911, p. 363) single record was from a vertical haul from a depth of 3000 meters.

Lubbockia squillimana Claus

[*Lubbockia squillimana* Claus, Die freilebenden Copepoden, p. 164, pl. 25, figs. 1-5, 1863.]

Well distributed in the Sargasso and Caribbean regions and in all the regions of the Pacific except the north (stations 116 to 132) and the south (stations 57 to 65). It was present in 1 nocturnal surface tow, 30 50-meter tows, and 33 100-meter tows, but did not appear at all in a diurnal surface tow. It is shorter and stouter than *aculeata*, and the posterior margins of the urosome segments are smooth. In the *Siboga* plankton it was taken once in a nocturnal surface tow.

Genus **LUCICUTIA** Giesbrecht, 1898

Two of the species of this genus were very widely distributed, one was confined to a single station, another was found at two stations only, and a fifth was rather rare but found in both oceans. All six of the species are practically confined to the two deeper tows and appear at the surface not at all or in such small numbers as to be negligible.



CHART II. Daytime vertical distribution of species of *Lucicutia*: (1) *bicornuta*, (2) *clausii*, (3) *curta*, (4) *flavicornis*, (5) *grandis*, (6) *longicornis*. One of the species was confined to the 100-meter tow, one appeared only in the two deeper tows, one was taken at the surface and 100 meters only, and the other three were most abundant in the 100-meter tow.

Lucicutia bicornuta Wolfenden

[*Lucicutia bicornuta* Wolfenden, Deut. Südpolar-Exped., 1901-1903, vol. 12, Zool., vol. 4, p. 321, fig. 63a-c, 1911.]

Not found in the Atlantic plankton, but obtained at three widely separated stations in the Pacific. The total number of specimens was 5, 3 of which were taken in the 100-meter tow and 2 in the 50-meter tow. Hence, so far as these few individuals are concerned the species is negative to light. It is evidently not abundant anywhere, since the majority of the specimens thus far recorded have been single individuals. It was first reported and has since been found chiefly in the temperate Atlantic.

Lucicutia clausii (Giesbrecht)

(Figure 54)

[*Leuckartia clausii* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 1, p. 812, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 359, 367, pl. 19, figs. 5, 6, 12-14, 24, 26, 27; pl. 38, fig. 37, 1892.]

This species was well distributed in both oceans except in the northern regions and the extreme southern part of the Pacific. It was present in 7 nocturnal and 2 diurnal surface

tows, 28 50-meter tows, and 73 100-meter tows, and in the vertical tow from 1000 meters at station 64. It is negative to light and stays below the surface in the daytime, but migrates upward at night. Six of the 8 specimens in the *Siboga* plankton were taken in vertical hauls from 1000 to 2000 meters.

Lucicutia curta Farran

(Figure 85)

[*Lucicutia curta* Farran, Ann. Rept. Fisheries, Ireland, 1902-03, pt. 2, app. 2, p. 44, pl. 12, figs. 1-7, 1905.]

Two specimens were obtained from the surface tow at station 54 and 2 from the 100-meter tow at station 74, and these were the only records for the cruise. This species was originally obtained in deep water off the coast of Ireland and later in the Antarctic, and it is possible that it remains below the 100-meter level in the daytime. But it evidently migrates to the surface at night, and under favorable conditions may stay long enough to be taken in the early forenoon.

Lucicutia flavicornis (Claus)

[*Leuckartia flavicornis* Claus, Die freilebenden Copepoden, p. 186, pl. 32, 1863.]

This was the most abundant and most widely distributed species of the genus, but was not found in the extreme north of the Atlantic or in the extreme south of the Pacific. It was present in 2 nocturnal and 3 diurnal surface tows, 30 50-meter tows, and 79 100-meter tows, and in the vertical tow from 1000 meters, station 64. It is thus negative to light; each of the daytime surface records was a single specimen, whereas it was often abundant in the deeper tows.

Lucicutia grandis (Giesbrecht)

(Figure 87)

[*Leuckartia grandis* Giesbrecht, Bull. Mus. Comp. Zool., Harvard Coll., vol. 25, p. 258, pl. 4, fig. 4, 1895.]

A few specimens of this species were found in the 100-meter tow at station 31 in the Caribbean Sea, and this is the only record for the cruise. The species, however, has been reported by Sars (1925, p. 208) and Wolfenden (1911, p. 315) as quite abundant in the temperate Atlantic at considerable depths, and also from the tropical Pacific by Giesbrecht. Farran (1929, p. 264) obtained 7 specimens in the Antarctic in a vertical haul from 1000 meters. The large pad on the ventral surface of the genital segment is a distinctive character.

Lucicutia longicornis (Giesbrecht)

[*Leuckartia longicornis* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 1, p. 813, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 359, 367, pl. 19, figs. 7, 30; pl. 38, fig. 39, 1892.]

This species was found at three localities in the Sargasso region and was widely scattered in the Pacific at stations long distances apart. It was captured in 1 nocturnal and 2 diurnal surface tows, 3 50-meter tows, and 12 100-meter tows, and in the vertical tow from 1000 meters, station 64. Hence, though staying in deeper water during the daytime,

it sometimes migrates to the surface at night. This species has apparently been recorded only by Giesbrecht (1892, p. 359) and Wolfenden (1911, p. 323).

Genus **MACROSETELLA** A. Scott, 1909

Macrosetella gracilis (Dana)

[*Setella gracilis* Dana, Proc. Amer. Acad. Arts and Sci., vol. 1, p. 154, 1847; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1198, 1853; pl. 84, fig. 3a-g, 1855.]

Found at nearly every station in the Atlantic south of 50° north latitude, and in every region of the Pacific with numerous gaps in the distribution. It was captured in 11 nocturnal and 42 diurnal surface tows, 55 50-meter tows, and 49 100-meter tows. It was often also evenly distributed at all three depths at the same time. Hence the vertical distribution indicates indifference to weak light, with the possibility of becoming negative as the light increases in strength. All the developmental stages from nauplius to adult were present in several of the surface tows.

Macrosetella oculata (G. O. Sars)

[*Setella oculata* G. O. Sars, Bull. Inst. océanogr. Monaco, no. 323, p. 13, pl. 7, 1916.]

This species is more tropical than *gracilis* and very much less abundant. It was found in both oceans in 2 nocturnal and 4 diurnal surface tows, 12 50-meter tows, and 17 100-meter tows. The four daytime surface records were single specimens, except one (*r*), so that the species is negative to light. The bright blue of the body and the red eyes usually retain their color in formalin, making identification easy. Most of the records of this species consist of single individuals, and no developmental stages were found.

Genus **MECYNOCERA** I. C. Thompson, 1888

Mecynocera clausi I. C. Thompson

[*Mecynocera clausi* I. C. Thompson, Jour. Linn. Soc. London, Zool., vol. 20, p. 150, pl. 11, 1888.]

Found everywhere in both oceans except the northern regions. It was taken in 4 nocturnal and 23 diurnal surface tows, 98 50-meter tows, and 90 100-meter tows, and in the vertical tow from 1000 meters, station 64. It was usually present in both deeper tows at the same time, and rarely in all three, hence its vertical distribution would indicate that it is indifferent to weak light but negative to strong light. Its small size, exceptionally long first antennae, and swollen genital segment are distinguishing characters.

Genus **MEGACALANUS** Wolfenden, 1904

Megacalanus longicornis (G. O. Sars)

[*Macrocalanus longicornis* G. O. Sars, Bull. Mus. océanogr. Monaco, no. 26, p. 7, 1905.]

This large species was well distributed in both oceans, especially the tropical parts. It was present in 8 nocturnal and 2 diurnal surface tows (in each of the latter a single

specimen), 39 50-meter tows, and 34 100-meter tows, and in the vertical tow from 1000 meters at station 64. It is, accordingly, negative to light, and migrates to the surface during the night. The first legs are armed with a stout curved spine or claw at the inner distal angle of the second basipod.

Megacalanus princeps (Brady)

[*Calanus princeps* Brady, Voyage of H.M.S. Challenger, Zool., vol. 8, pt. 24, Copepoda, p. 36, pl. 6, figs. 3-7, 1883.]

This species is larger than the preceding and was also found in both oceans, but in much smaller numbers. It was taken in 1 daytime surface tow, 5 50-meter tows, and 5 100-meter tows, but did not appear in any of the nocturnal surface tows. It was also in the vertical tow from 1000 meters at station 64. Sars (1925, p. 14) has reported this copepod in deep-water hauls in both oceans, and Brady (1883, p. 36) found it in the *Challenger* plankton from the North Atlantic at a depth of 1250 fathoms.

Genus **MESOCYCLOPS** G. O. Sars, 1914

Mesocyclops leuckarti (Claus)

[*Cyclops leuckarti* Claus, Arch. f. Naturgesch. (Berlin), vol. 23 (1), p. 35, pl. 1, fig. 4; pl. 2, figs. 13, 14, 1857.]

A few specimens of this well known species were found in a lagoon or pond on Penrhyn Island in the tropical Pacific. The water must have been at least brackish if not saline, since the other nine species taken at this locality were all typical marine forms.

Genus **METIS** Philippi, 1843

Metis jousseaumei (Richard)

[*Ilyopsyllus jousseaumei* Richard, Bull. Soc. zool. France, vol. 17, p. 69, 1892.]

Two females of this minute harpacticid were present in a surface tow taken at the ship's anchorage at Hanga Roa, Easter Island. The anchorage must have been in an open roadstead, since this was the only species to give an idea of the proximity of land, and all the other species were pelagic forms.

Genus **METRIDIA** Boeck, 1865

Metridia brevicauda Giesbrecht

[*Metridia brevicauda* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 2, p. 24, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 340, 346, pl. 33, figs. 5, 10, 11, 14, 21, 26, 32, 1892.]

Not found in the Atlantic plankton, and in the Pacific practically confined to a few localities in the southeastern region. It was taken in 1 nocturnal surface tow, 2 50-meter tows, and 6 100-meter tows. These few specimens were negative to light but showed occasional migration to the surface at night. All the specimens (22) in the *Siboga* plankton were captured in vertical hauls from depths of 750 to 1500 meters. The species has been reported from the South Atlantic by Cleve (1904, p. 192).

Metridia curticauda Giesbrecht

[*Metridia curticauda* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 2, p. 24, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 340, 346, pl. 32, fig. 7; pl. 33, figs. 4, 15, 33, 1892.]

Not found in the Pacific plankton and confined to two localities in the eastern Atlantic. It was present in 1 nocturnal and 1 diurnal surface tow and 1 100-meter tow. Farran (1929, p. 259) reported numerous specimens in the Antarctic from depths of 600 meters or more, so this is apparently a deep-water form, which does not often rise to the 100-meter level in the daytime.

Metridia longa (Lubbock)

[*Calanus longus* Lubbock, Ann. and Mag. Nat. Hist., ser. 2, vol. 14, p. 127, pl. 5, fig. 10, 1854.]

Found at four Atlantic and six Pacific localities, the latter chiefly in the western region. It was captured in 3 nocturnal surface tows, 3 50-meter tows, and 7 100-meter tows, and in the vertical tow from 1000 meters, station 64; hence it is negative to light and migrates to the surface in the night. It has been reported by Sars (1925, p. 198) from the Arctic Ocean as far north as Spitzbergen and seems to be a more or less boreal form.

Metridia lucens Boeck

(Figure 70)

[*Metridia lucens* Boeck, Forhandl. Vidensk. Selsk. Christiania, p. 238, 1865.]

Found at a single Atlantic station (11) and at fifteen Pacific stations, chiefly in the northern part above latitude 40° north. It was present in 7 50-meter tows and 10 100-meter tows, and in the vertical tow from 1000 meters at station 64, but was not found at the surface. The fifth legs of the female are three-segmented, each end segment having three terminal setae and one on the outer margin.

Metridia princeps Giesbrecht

(Figure 102)

[*Metridia princeps* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 2, p. 24, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 340, 346, pl. 32, fig. 21; pl. 33, figs. 3, 18, 35, 40, 1892.]

Not found in the Atlantic plankton and confined to the single vertical tow from 1000 meters at station 64 in the southeastern Pacific, from which 3 females were obtained. The fifth legs of the female are four-segmented, the basal segment with a tuft of long filiform setae, the terminal segment with three plumose setae.

Genus **MICROCALANUS** G. O. Sars, 1901

Microcalanus pusillus G. O. Sars

[*Microcalanus pusillus* G. O. Sars, Crustacea of Norway, vol. 4, p. 156, suppl. pl. 2, pl. 3, fig. 1, 1903.]

Abundant in the Sargasso and Caribbean regions and scattered in every region of the Pacific, with five or six large

gaps in the distribution. It was taken in 11 nocturnal and 10 diurnal surface tows, 39 50-meter tows, and 42 100-meter tows. It migrates to the surface in the night and apparently does not return immediately on the approach of daylight, but is negative to strong light.

Microcalanus pygmaeus (G. O. Sars)

(Figure 55)

[*Pseudocalanus pygmaeus* G. O. Sars, Norwegian North Polar Exped., 1893-1896, Sci. res., vol. 5, Crustacea, p. 73, pl. 21, 1900.]

Found at only two stations in the tropical Atlantic, but more abundant than *pusillus* in the Pacific. It was present in 12 nocturnal and 21 diurnal surface tows, 60 50-meter tows, and 57 100-meter tows. Like the previous species, it migrates to the surface in the night and lingers there in the morning, but is negative to strong light.

Genus **MICROSETELLA** Brady and Robertson, 1873

Microsetella norvegica (Boeck)

[*Setella norvegica* Boeck, Forhandl. Vidensk. Selsk. Christiania, p. 281, 1865.]

Found at nearly every locality in the Atlantic, but very scattering in the Pacific. It was present in 7 nocturnal and 28 diurnal surface tows, 41 50-meter tows, and 32 100-meter tows. The minute size, the laterally compressed body, and the short caudal setae are distinguishing characters.

Microsetella rosea (Dana)

[*Canthocamptus roseus* Dana, U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1189, 1853; pl. 83, fig. 10, 1855.]

Very scattering in the Atlantic but abundant and widely distributed in the Pacific. It was taken in 12 nocturnal and 43 diurnal surface tows, 83 50-meter tows, and 86 100-meter tows. It is probably negative to strong light and migrates to the surface during the night. It is about twice the size of *norvegica* and usually rosy in color, with caudal setae much longer than the body.

Genus **MIRACIA** Dana, 1846

Miracia efferata Dana

[*Miracia efferata* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 46, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1260, 1853; pl. 88, fig. 11, 1855.]

This species was widely scattered in both oceans, but the localities were long distances apart, and the abundance records were nearly all numerals. It was present in 2 nocturnal and 19 diurnal surface tows, 19 50-meter tows, and 19 100-meter tows. Such a uniform vertical distribution strongly suggests that the species is indifferent to light. Very often the bodies of the specimens preserved in formalin still showed their original red and blue colors.

Genus **MONSTRILLA** Dana, 1849**Monstrilla inserta** A. Scott

[*Monstrilla inserta* A. Scott, Copepoda of the Siboga Exped., vol. 29a, pt. 1, p. 237, pl. 57, figs. 7, 8, 1909.]

This species was not present in the Atlantic plankton and was taken at two stations (109 and 112) only in the Pacific, in the 50-meter tows. The short first antennae and the structure of the fifth legs are distinctive characters. All the *Siboga* specimens were taken at the surface, once at night and twice in the daytime, but the *Carnegie* specimens had migrated downward to the 50-meter level.

Genus **NEOCALANUS** G. O. Sars, 1925**Neocalanus gracilis** (Dana)

(Figure 84)

[*Calanus gracilis* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 18, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1078, 1853; pl. 74, fig. 10, 1855.]

Found at four Atlantic stations and well distributed throughout the entire Pacific. It was taken in 17 nocturnal and 18 diurnal surface tows, 72 50-meter tows, and 78 100-meter tows, as well as at station 64 in the vertical tow from 1000 meters. It therefore migrates to the surface at night and is probably negative to strong light. The exceptionally long antennae and the peculiarly barbed terminal spine on the exopod of the first legs identify the species. Sars (1925, p. 7) reported this species from 112 stations of the various Monaco expeditions, the majority of the species from depths greater than 100 meters.

Neocalanus robustior (Giesbrecht)

[*Calanus robustior* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 332, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 91, 129, pl. 7, figs. 19, 25, 30; pl. 8, fig. 34, 1892.]

Not present in the Atlantic plankton, but well distributed in the Pacific. It was found in 13 nocturnal and 1 diurnal surface tow, 49 50-meter tows, and 51 100-meter tows, and in the vertical tow from 1000 meters, station 64. It is more negative to light than the preceding species, and migrates to the surface at night. The shorter and stouter first antennae and the left fifth foot of the male characterize the species. This species was reported by Sars (1925, p. 8) from only ten of the Monaco stations, and is evidently not so widely distributed as *gracilis*.

Neocalanus tenuicornis (Dana)

[*Calanus tenuicornis* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 15, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1069, 1853; pl. 73, fig. 10a, b, 1855.]

Found at four Atlantic stations and sparingly distributed in the Pacific except in the southeastern part. It was present in 8 nocturnal and 4 diurnal surface tows, 32 50-meter tows, and 52 100-meter tows. The exceptionally long and filiform

first antennae serve to distinguish the species, which is less widely distributed than *robustior*.

Genus **NESIPPUS** Heller, 1865**Nesippus** species

(Figure 31)

One male *Nesippus* was taken at the surface in the western Pacific, station 106, the only record for the cruise. It resembled Dana's *Specilligus curticaudis* (1849, p. 58; 1853, p. 1375, pl. 95, fig. 6a-h), but differed in many particulars, especially the frontal plates, the anterior and posterior margins of the carapace, and the abdomen. It was impossible to decide from the single specimen whether it was to be regarded as a variety or a separate species. A drawing is here included for comparison with other species of the genus and as an aid in future identification (fig. 31).

Genus **OITHONA** Baird, 1843

This genus of cyclopoid copepod is characterized by the small size of the species and by the slender and elongated urosome. The present records show that all the species frequent the two deeper tows in preference to the surface. In geographical distribution, however, the genus as a whole shows but little partiality for any region or zone, since most stations in both oceans yielded from one to five species. The average number of species for each station for the entire cruise was three, but the number was somewhat larger in the southeastern and central Pacific and considerably smaller in the northern regions of both oceans.

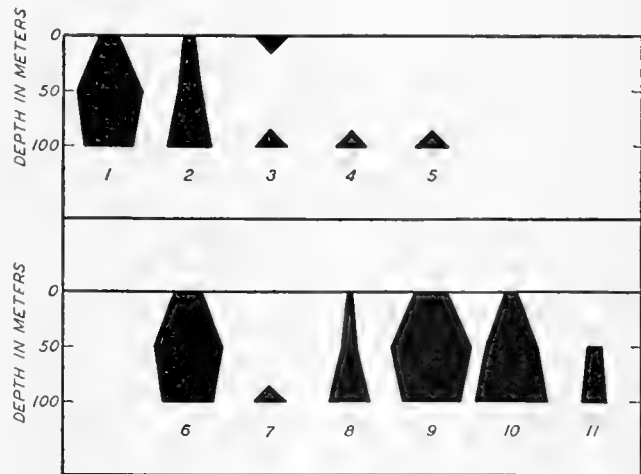


CHART 12. Daytime vertical distribution of species of *Oithona*: (1) *attenuata*, (2) *brevicornis*, (3) *fallax*, (4) *hebes*, (5) *linearis*, (6) *plumifera*, (7) *robusta*, (8) *setiger*, (9) *similis*, (10) *spinirostris*, (11) *vivida*. Three species appeared only in the 100-meter tow; one was found at the surface and in the 100-meter tow, but not in the 50-meter tow; one was confined to the two deeper tows. The other six species were present at all three depths and were least abundant at the surface. Three of them were most abundant in the 50-meter tow and the other three in the 100-meter tow. The two species *similis* and *spinirostris* were by far the most numerous, and the former was the one that appeared most often in the nocturnal surface tows.

***Oithona attenuata* Farran**

[*Oithona attenuata* Farran, Proc. Zool. Soc. London, 1913, p. 187, pl. 30, figs. 3-7, 1913.]

Not found in the Atlantic plankton, but well scattered in the Pacific with numerous large gaps in distribution. It was present in 4 nocturnal and 15 diurnal surface tows, 53 50-meter tows, and 46 100-meter tows. It is thus negative to light, but stops at a depth of 50 meters more often, and with larger abundance records, than at 100 meters. This would be a good species to test for vertical distribution at intervals of 10 meters, and would probably yield interesting data, especially between the surface and the 50-meter level.

***Oithona brevicornis* Giesbrecht**

[*Oithona brevicornis* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 475, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 538, 549, pl. 34, figs. 6, 7, 1892.]

Not found in the Atlantic plankton, and virtually confined to the southeastern region of the Pacific. It was taken in 3 nocturnal and 3 diurnal surface tows, 6 50-meter tows, and 11 100-meter tows. With few exceptions the abundance records were expressed in numerals, indicating that the species is comparatively rare. It is also one of the smallest species, and this, with the short antennae and sharply curved rostrum, will serve to distinguish it. It has been reported by Sewell (1924, p. 792) from the brackish water of Chilka Lake in British India.

***Oithona fallax* Farran**

[*Oithona fallax* Farran, Proc. Zool. Soc. London, 1913, p. 185, pl. 27, figs. 9-12; pl. 28, figs. 1-3, 1913.]

Not found in the Atlantic plankton and confined to six stations in the Pacific, four in the southeastern region at Merriam Ridge (stations 65 to 68) and two in the central part north of Samoa. It was present in 3 surface tows and 5 100-meter tows, but did not appear in any 50-meter tow. It was originally described by Farran (1913, p. 185) from specimens taken at Christmas Island in the Indian Ocean, but this is the first record from the Pacific.

***Oithona hebes* Giesbrecht**

[*Oithona hebes* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 475, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 538, 549, pl. 34, figs. 8, 9, 1892.]

This species was not present in the Pacific plankton and was found only at station 30 in the Caribbean Sea, in the 100-meter tow. It has very short first antennae and a swollen metasome, giving it much the appearance of *Cyclops*. It has been reported from the tropical Pacific by Giesbrecht (1892, p. 538), but this is the first record from the tropical Atlantic.

***Oithona linearis* Giesbrecht**

[*Oithona linearis* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 475, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 538, 548, pl. 34, figs. 1, 2, 1892.]

Two specimens were found in the 100-meter tow at station 68 in the southeastern Pacific, and this was the only record for the cruise. It was originally reported from the tropical Pacific, the specimens obtained by Giesbrecht and afterward by Wolfenden (1911, p. 363) having been taken in vertical hauls from depths of 400 to 4000 meters. This fact helps to explain its scarcity in the *Carnegie* plankton, and it must be regarded as a deep-water form.

***Oithona plumifera* Baird**

[*Oithona plumifera* Baird, The Zoologist (Newman), vol. 1, p. 59, 1843.]

This species was well distributed in both oceans, but was not present at stations 10 to 18 (Atlantic), 58 to 68 (except 62) and 115 to 137 (Pacific). It was taken in 8 nocturnal and 20 diurnal surface tows, 65 50-meter tows, and 53 100-meter tows. It is probably more or less indifferent to ordinary light, but becomes negative to strong light and shows a preference for the 50-meter tow rather than the 100-meter tow. The characteristic plumes are usually lacking in preserved material.

***Oithona robusta* Giesbrecht**

[*Oithona robusta* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 476, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 538, 549, pl. 34, figs. 4, 5, 16, 17, 1892.]

A few females of this species were obtained in the 100-meter tow at station 157 in the tropical Pacific, and this was the only record for the cruise. It is the largest and stoutest of the species, and has a long and sharply pointed rostrum, curved over ventrally so that it is visible in dorsal view. It was originally obtained from the tropical Pacific a little farther west than this *Carnegie* location.

***Oithona setiger* Dana**

[*Oithona setiger* Dana, U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1101, 1853; pl. 76, fig. 6a-f, 1855.]

This species was present at eight Atlantic stations and ten Pacific stations. It was taken in 2 nocturnal and 3 diurnal surface tows, 4 50-meter tows, and 11 100-meter tows. The comparatively few specimens obtained thus showed a preference for the 100-meter depth when migrating away from the light. The 2 nocturnal surface tows indicate that the species sometimes visits the surface at night. Giesbrecht's (1891, p. 475; 1892, p. 538) records were from the tropical Pacific and included various depths down to 1000 meters.

***Oithona similis* Claus**

[*Oithona similis* Claus, Die Copepoden-Fauna von Nizza, p. 14, 1866.]

This is the most abundant and most widely distributed species, not only of its own genus but also of all the plankton copepods. It was found at 92 per cent of all localities throughout the cruise, and the number of specimens in many of the

tows ran into the hundreds. It was taken in 20 nocturnal and 65 diurnal surface tows, 129 50-meter tows, and 120 100-meter tows, as well as in the vertical tow from 1000 meters, station 64. As this record would indicate, it is more or less indifferent to light and was often found equally distributed in all three tows at the same time. In view of this *Carnegie* record, it seems strange that the species did not appear at all in the *Siboga* plankton.

Oithona spinirostris Claus

[*Oithona spinirostris* Claus, Die freilebenden Copepoden, p. 105, pl. 11, 1863.]

This species was also well distributed in both oceans, but not so widely or so abundantly as *similis*. It was present in 3 nocturnal and 8 diurnal surface tows, 77 50-meter tows, 84 100-meter tows, and at station 64 in the vertical tow from 1000 meters. This record shows a definite aversion to light, and some preference for the 100-meter tow; the surface records are very small as compared with the two deeper tows. Farran (1908a, p. 500) gave to this species the new name *atlantica*, but Sars (1913, p. 6) has clearly shown that it is the same as the species designated *spinirostris* by Claus (1863, p. 105), and the latter name must be retained.

Oithona vivida Farran

[*Oithona vivida* Farran, Proc. Zool. Soc. London, 1913, p. 183, pl. 27, figs. 1-8, 1913.]

Three females of this species were obtained at station 37 in the eastern tropical Pacific, 1 specimen in the 50-meter tow and 2 in the 100-meter tow. It was originally obtained by Farran (1913, p. 183) from the vicinity of Christmas Island in the Indian Ocean, and hitherto has not been reported in other collections. It is thus a rare species. These 3 specimens showed an aversion to light, whereas those described by Farran were taken in shallow water near the shore; the depth of the tow was not given.

Genus OITHONINA Sars, 1913

Oithonina nana (Giesbrecht)

[*Oithona nana* Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, pp. 538, 549, pl. 4, fig. 8; pl. 34, figs. 10, 11, 20, 24; pl. 44, figs. 4, 6, 1892.]

This species was widely scattered in both oceans, but with numerous gaps in the distribution. It was taken in 6 nocturnal and 15 diurnal surface tows, 32 50-meter tows, and 36 100-meter tows. It is thus probably somewhat indifferent to ordinary light, but becomes more or less negative to strong light, and retires from the surface. It is included by many authors in the genus *Oithona*, but Sars (1913, p. 5) has given good reasons for considering it a separate genus.

Genus ONCAEA Philippi, 1843

Like *Oithona*, this is a genus of cyclopoid copepods, all of whose species are small, but are inclined to corpulence rather

than slenderness. The Caribbean region of the Atlantic and the eastern tropical and southeastern temperate regions of the Pacific contained the largest number of species as well as individuals. The *Carnegie* records show a definite preference for the deeper tows rather than the surface. Stations 35 to 65 yielded from one to ten species apiece, with an average of six, and it is worthy of note that all these stations are in that region of the Pacific where the oceanic currents are most numerous and active.

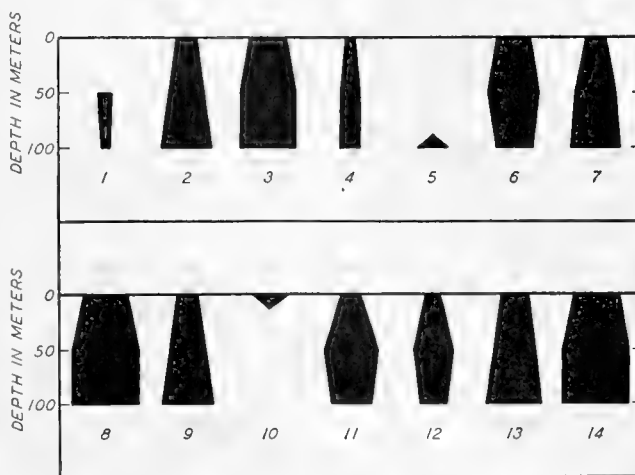


CHART 13. Daytime vertical distribution of species of *Oncaea*: (1) *anglica*, (2) *conifera*, (3) *curta*, (4) *curvata*, (5) *dentipes*, (6) *media*, (7) *mediterranea*, (8) *minuta*, (9) *notopa*, (10) *ornata*, (11) *similis*, (12) *subtilis*, (13) *tenella*, (14) *venusta*. One species was confined to the surface, one to the 100-meter tow, and one to the two deeper tows. Each of the remaining eleven species was least abundant at the surface and more abundant in the two deeper tows. Four of them were most abundant in the 100-meter tow, three were most abundant in the 50-meter tow, and the other four were evenly divided between the two deeper tows. Attempts have been made by various authors, beginning with Johannes Müller, to divide the plankton into horizontal zones according to the depth at which it is found. In any such division the species of this genus would probably be regarded as belonging to the surface zone, since it is doubtful if any of them descend much below the upper 100 meters, practically the surface when compared with the depths of the ocean. Yet the majority of the species show within their limited habitat a more or less well defined aversion to the actual surface layer and a preference for the two greater depths. [*O. ornata* was taken only at night.—Ed.]

Oncaea anglica Brady

[*Oncaea anglica* Brady, Trans. Nat. Hist. Soc. Northumberland and Durham, n. s., vol. 1, p. 220, pl. 6, figs. 1-9, 1905.]

Not found in the Atlantic plankton, and confined to the first two stations in the tropical Pacific after passing through the Panama Canal. Two females were taken in the 50-meter tow at station 35 and 1 in the 100-meter tow at station 36. These 3 specimens were evidently negative to light, but the number is too small to warrant a general statement. The species was originally obtained from the North Atlantic, and this is the first record from the Pacific.

***Oncaea conifera* Giesbrecht**

[*Oncaea conifera* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 477, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 591, 603, pl. 2, fig. 10; pl. 47, figs. 4, 16, 21, 23, 28, 34-38, 42, 55, 56, 1892.]

This species was found at three stations in the Caribbean Sea and was well scattered in the Pacific, especially in the southeastern region. It was taken in 1 nocturnal and 4 diurnal surface tows, 10 50-meter tows, and 15 100-meter tows, and in the vertical tow from 1000 meters at station 64. More than half the abundance records were numerals, indicating that the species is nowhere plentiful. It is, however, rather widely distributed, and has been reported from nearly every ocean, including the Arctic and Antarctic. Farran in his account of the Copepoda of the *Terra Nova* expedition (1929, p. 285) recorded it as "taken three times in hauls beneath the ice."

***Oncaea curta* G. O. Sars**

[*Oncaea curta* G. O. Sars, Bull. Inst. océanogr. Monaco, no. 323, p. 11, pl. 4, 1916.]

Found between stations 1 and 2 and at three stations in the central tropical Atlantic, and in every region of the Pacific, but in small numbers and with numerous gaps in its distribution. It was taken in 13 nocturnal and 19 diurnal surface tows, 24 50-meter tows, and 24 100-meter tows, and in the vertical tow from 1000 meters, station 64. This record suggests considerable indifference to light with a slight preference for the two deeper tows. As far as is known, this is the first record of the species outside the Mediterranean, where it was originally obtained. The relative size of the genital segment as compared with the rest of the urosome was given by Sars (1916, p. 11) as the most evident character of the species.

***Oncaea curvata* Giesbrecht**

(Figure 45)

[*Oncaea curvata* Giesbrecht, Rés. voyage S.Y. Belgica, 1897-99, Copepoden, p. 42, pl. 13, figs. 12-17, 1902.]

Not present in the Atlantic plankton, and in the Pacific confined to stations 35 to 61, with a single exception. It was taken in 1 nocturnal and 1 diurnal surface tow, 4 50-meter tows, and 4 100-meter tows. In every instance the number of specimens was very small, and the species is evidently rare. Farran in his account of the Copepoda of the *Terra Nova* expedition (1929, p. 286) stated that this species was "frequent in the Antarctic, especially under the ice at Winter Quarters."

***Oncaea dentipes* Giesbrecht**

(Figure 49)

[*Oncaea dentipes* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 477, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 591, 603, pl. 47, figs. 7, 17, 41, 51, 52, 1892.]

A single female was taken in the 100-meter tow at station 55, and this was the only record for the cruise. It was originally reported by Giesbrecht (1891, p. 477; 1892, p. 591)

from nearly the same locality, and one specimen was obtained in the *Terra Nova* plankton (Farran, 1929, p. 286) off New Zealand in a vertical haul from 100 meters depth.

***Oncaea media* Giesbrecht**

[*Oncaea media* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 477, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 591, 602, pl. 2, fig. 12; pl. 47, figs. 1, 11, 29-33, 40, 1892.]

Well distributed in both oceans except in the northern regions. It was taken in 24 nocturnal and 36 diurnal surface tows, 39 50-meter tows, and 37 100-meter tows, and in the vertical tow from 1000 meters at station 64. It was repeatedly found in similar abundance in all three tows at the same time, and hence must be regarded as practically indifferent to light. It was found at the surface so often in the daytime that its presence there at night can scarcely be regarded as evidence of migration.

***Oncaea mediterranea* Claus**

(Figure 44)

[*Oncaea mediterranea* Claus, Die freilebenden Copepoden, p. 159, pl. 30, figs. 1-7, 1863.]

Not present in the Atlantic plankton, and in the Pacific found chiefly at stations 54 to 65. It was taken in 14 nocturnal and 3 diurnal surface tows, 9 50-meter tows, and 12 100-meter tows, and in the vertical tow from 1000 meters at station 64. It is found almost entirely in the two deeper tows during the daytime, but migrates to the surface at night. It was recorded by Farran (1929, p. 285) as "scarce in the Atlantic but common off New Zealand. Most of the New Zealand specimens retained their orange or golden color after preservation." This last statement is also true of the *Carnegie* specimens, many of which were still very brightly colored after four years in formalin.

***Oncaea minuta* Giesbrecht**

(Figure 47)

[*Oncaea minuta* Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, pp. 591, 603, pl. 47, figs. 3, 6, 26, 46, 59, 1892.]

This is one of the most widely distributed and abundant species of the genus in both oceans. It was taken in 33 nocturnal and 63 diurnal surface tows, 106 50-meter tows, and 102 100-meter tows. It was recorded as abundant one hundred times and as common one hundred times more. It showed a definite preference for the two deeper tows in the daytime, but migrated regularly to the surface at night.

***Oncaea notopa* (Giesbrecht)**

(Figure 46)

[*Oncaea notopus* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 477, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 591, 603, pl. 47, figs. 12, 15, 45, 1892.]

Found at only four Atlantic stations, but more widely scattered in the Pacific, with numerous and extensive gaps

in the distribution, one of them including all the stations from 69 to 106 inclusive. It was present in 15 nocturnal and 11 diurnal surface tows, 16 50-meter tows, and 19 100-meter tows, and in the vertical tow from 1000 meters at station 64. The preference for the two deeper tows in the daytime was only slight, and the species would seem to be somewhat indifferent to light. The species was reported by Giesbrecht (1891, p. 477; 1892, p. 591) from the tropical Pacific down to 1000 meters, and by Sars (1900, p. 107) from the Arctic Ocean north of the New Siberian Islands.

***Oncaea ornata* Giesbrecht**

(Figure 48)

[*Oncaea ornata* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 477, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 591, 604, pl. 44, figs. 50, 51; pl. 47, figs. 20, 24, 49, 53, 1892.]

Five females were obtained in a surface tow off Samoa Island at night, and this was the only record for the cruise. The species was originally reported by Giesbrecht (1891, p. 477; 1892, p. 591) from the eastern tropical Pacific, and has not been noted in the plankton of any expedition since then. It is thus very rare, and is probably much restricted in distribution.

***Oncaea similis* G. O. Sars**

[*Oncaea similis* G. O. Sars, Crustacea of Norway, vol. 6, p. 193, pl. 109, fig. 1, 1918.]

Found at three localities in the Atlantic and well distributed in the southeastern and eastern Pacific, but extremely scattering elsewhere. It was present in 16 nocturnal and 9 diurnal surface tows, 30 50-meter tows, and 24 100-meter tows, and in the vertical tow from 1000 meters, station 64. It thus showed a definite choice of the deeper tows in the daytime and a habitual resort to the surface at night. This is the first record of this species from the Pacific Ocean.

***Oncaea subtilis* Giesbrecht**

[*Oncaea subtilis* Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, pp. 591, 603, pl. 47, figs. 14, 18, 25, 43, 60, 1892.]

Found at only two of the Caribbean Sea stations and almost entirely at the eastern tropical stations in the Pacific. It was taken in 4 nocturnal and 4 diurnal surface tows, 8 50-meter tows, and 6 100-meter tows. Not enough specimens were obtained to warrant any general conclusions, but it seems fairly evenly distributed among the three depths and hence might be considered as probably indifferent to light.

***Oncaea tenella* G. O. Sars**

[*Oncaea tenella* G. O. Sars, Bull. Inst. océanogr. Monaco, no. 323, p. 12, pl. 5, 1916.]

Found at two Caribbean and three mid-tropical Atlantic stations, but chiefly in the southeastern Pacific. It was present in 12 nocturnal and 9 diurnal surface tows, 14 50-meter tows, and 18 100-meter tows, and in the vertical tow from 1000 meters at station 64. It showed, therefore, a

moderate preference for the deeper tows by day and migration to the surface at night. This is another of Sars' (1916, p. 12) species, and was originally obtained from the Mediterranean.

***Oncaea venusta* Philippi**

[*Oncaea venusta* Philippi, Arch. f. Naturgesch. (Wiegmann), vol. 1, Jahrg. 9, p. 63, fig. 3, 1843.]

This shares with *minuta* the widest distribution and the greatest abundance of any species of the genus. Indeed, they are surpassed in these respects only by *Oithona similis* among all the copepods of the *Carnegie* plankton. This species was captured in 31 nocturnal and 80 diurnal surface tows, 103 50-meter tows, and 102 100-meter tows, and in the vertical tow from 1000 meters at station 64. It was recorded one hundred and fifty-four times as abundant and one hundred times as common. It was found more often than any other copepod distributed equally at all three depths at the same time. It is therefore indifferent to light, and its vertical distribution is exceptionally uniform.

Genus **ONCHOCALANUS** G. O. Sars, 1905

***Onchocalanus cristatus* (Wolfenden)**

(Figure 90)

[*Xanthocalanus cristatus* Wolfenden, Jour. Marine Biol. Assoc., n. s., vol. 7, no. 1, p. 119, pl. 9, figs. 18, 19, 1904.]

A single female was taken in the vertical tow from a depth of 1000 meters at station 64 in the southeastern Pacific, and this was the only record for the entire cruise. This species occurred twice in the *Siboga* plankton in vertical hauls from depths of 1000 and 1536 meters respectively. It is probably, therefore, a deep-water species which stays below the 100-meter level at least in the daytime.

***Onchocalanus nudipes*, new species**

(Figures 71-83)

Occurrence. About 40 specimens in various stages of development were taken in the eastern, central, and western parts of the tropical Pacific, but none were found in the Atlantic plankton. They were captured in 6 surface tows, 2 50-meter tows, and 3 100-meter tows. No adult males were obtained, although some of the younger stages were probably undeveloped males.

Description of female. Body pyriform, the metasome considerably widened and much inflated dorsally and ventrally, the urosome one-fourth as long and one-fifth as wide as the metasome and four-segmented. The head is separated from the first segment, and the fourth from the fifth segment. The genital segment is half the length of the urosome and a little wider than the abdomen. The three abdominal segments are equal in length and width, but the anal segment is shortened at the sides. The caudal rami are as wide as long, divergent, and each is armed with four setae of about equal length.

The first antennae are slender and twenty-four-segmented, and reach the middle of the urosome. The exopod of the second antenna is twice as long as the endopod and six-segmented, the second segment twice as long as the first.

The second maxillae are stout and the last lobe of the basilar part terminates in a very long and strong claw, curved backward and ending in a sharp point. At the base of the claw on the inside are two or three long setae. The terminal part is folded against the base of the claw and is armed with five or six sensory appendages and two long setae. The maxillipeds are long and slender; the proximal segment of the basal part is somewhat swollen, with small setae on the inner margin; the distal segment is narrower and a little longer, with three setae nearer the basal end. The terminal part is made up of five segments, the second one the longest, the terminal one very minute.

The exopods of the swimming legs are all three-segmented; the endopods of the first four pairs have one, two, three, and three segments respectively. The first legs have no spines on the posterior surface; the terminal segment of the second endopod has a proximal group of three and a distal group of four spines in an oblique row. The second segment of the third endopod has six spines and the end segment has five; the second segment of the third exopod carries a transverse row of very slender spines close to the base of the segment; the second segment of the fourth endopod has two groups of three spines each in a longitudinal row, and the third segment has a transverse row of three spines near the distal end. The fifth legs are uniramous, three-segmented, and entirely destitute of hairs, whence the specific name. The terminal segment is conical, with three minute spines at the tip and one on the outer margin near the center.

Total length, 2.25 mm; length of metasome, 1.95 mm; width, 1.15 mm.

Type. U. S. Nat. Mus. no. 64004.

Remarks. This is much the smallest species of the genus, and looks more like *Pachos* than like any other *Onchocalanus* species. The strong claw on the second maxillae, the bifurcate rostrum, and the spines on the posterior surfaces of the swimming legs necessitate the reference of the species to the present genus. The species can be identified by the small size, the pyriform shape, and the entire lack of hairs on the fifth legs.

Onchocalanus trigoniceps G. O. Sars

(Figure 96)

[*Onchocalanus trigoniceps* G. O. Sars, Bull. Mus. océanogr. Monaco, no. 26, p. 20, 1905.]

A single female of this species was taken in the vertical tow from a depth of 1000 meters at station 64 in the south-eastern Pacific. This is larger than *cristatus*, but lacks the frontal crest, and is another deep-water species that stays below the 100-meter level in the daytime. It has been reported before from the Atlantic, the Mediterranean, and the Antarctic oceans, but not from the Pacific.

Genus *PACHOS* Stebbing, 1910

Pachos punctatum (Claus)

[*Pachysoma punctata* Claus, Die freilebenden Copepoden, p. 163, pl. 25, 1863.]

This species was found in a surface tow between stations 1 and 2, near the Sargasso region, and at nine widely sepa-

rated stations in the Pacific, no two of them being consecutive or even close together. It was taken in 2 surface tows, 3 50-meter tows, and 5 100-meter tows, all the abundance records being expressed in numerals. The inference from these meager statistics would be that it is nowhere abundant and that it prefers the deeper levels during the daytime. It was originally reported by Claus (1863, p. 163) from Messina in the Mediterranean, and afterward by Brady (1883, p. 121) in the *Challenger* plankton from the Philippine Islands, and by A. Scott (1909, p. 262) in the *Siboga* plankton from the western tropical Pacific. As far as is known, the present is the first record from the northern Atlantic.

Pachos tuberosum (Giesbrecht)

[*Pachysoma tuberosum* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 478, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 612, 615, pl. 48, fig. 37, 1892.]

This species was not found in the Atlantic plankton, but appeared at four scattered stations in the tropical Pacific. It was not present in any surface tow, but was taken in 2 50-meter tows and 4 100-meter tows. These records are even more scanty than those for the preceding species, but, as far as they go, indicate that the species remains at the lower levels during the daytime. It has been reported by Giesbrecht (1891, p. 478; 1892, p. 612) from the Gulf of Panama and by Cleve (1904, p. 194) from the South Atlantic.

Genus *PACHYPTILUS* G. O. Sars, 1920

Pachyptilus abbreviatus (G. O. Sars)

[*Pontoptilus abbreviatus* G. O. Sars, Bull. Mus. océanogr. Monaco, no. 40, p. 19, 1905.]

The *Carnegie* plankton has yielded the first Pacific records for this species, a juvenile male captured in the 50-meter tow at station 39 and a single female from 100 meters at station 113. This species is considerably larger than either species of *Pachos*. It lacks the small frontal projection, and the endopod of the fifth legs is one-segmented. Hitherto, *Pachyptilus abbreviatus* has been reported only from the temperate Atlantic by Sars (1925, p. 319) and Rose (1929, p. 36), the latter stating that all the species of this genus live at great depths in the ocean.

Genus *PANDARUS* Leach, 1816

Pandarus satyrus Dana

[*Pandarus satyrus* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 59, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1367, 1853; pl. 95, fig. 1a-c, 1855.]

Fifteen specimens were taken from the fins and skin of a large shark captured at station 110. This species, named *zygaenae* by Brady (1883, p. 134), is usually found on sharks of the genus *Zygaena*. The present host was not recorded, but may well have belonged to that genus. Dana's (1849, p. 59) original specimens came from the central tropical

Pacific off Tongatabu Island; the present specimens were captured farther west and north, near the Fleming Deep.

Pandarus sinuatus Say

[*Pandarus sinuatus* Say, Jour. Acad. Nat. Sci. Phila., vol. 1, p. 436, 1818.]

A single female was captured in one of the nocturnal surface tows taken between stations 35 and 36 in the eastern tropical Pacific. It was about two-thirds grown and had not yet fastened upon a host, but remained swimming freely with the other plankton copepods. This species is very common along the Atlantic coast of North America, but this is the first record from the Pacific.

Genus **PARACALANUS** Boeck, 1865

Paracalanus aculeatus Giesbrecht

(Figure 101)

[*Paracalanus aculeatus* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 332, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 164, 170, pl. 9, figs. 20, 26, 30, 1892.]

Not found in the Atlantic plankton, and in the Pacific confined to the southeastern and central parts. It was taken in 3 nocturnal and 5 diurnal surface tows, 14 50-meter tows, and 11 100-meter tows. It sometimes remains at the surface, but is more often found in the two deeper tows. The radiating setae on the caudal rami are often red in the male. Farran (1929, p. 222) has recorded the species as "frequent in the tropical Atlantic and very abundant at some stations."

Paracalanus parvus (Claus)

[*Calanus parvus* Claus, Die freilebenden Copepoden, p. 173, pl. 26, figs. 10-14, 1863.]

This small species was very well distributed in both oceans, and approached close to *Oithona* and *Oncaea* in abundance. It was taken in 41 nocturnal and 101 diurnal surface tows, 128 50-meter tows, and 118 100-meter tows. Such vertical distribution indicates that the species is practically indifferent to light, and this conclusion is supported by the fact that it is repeatedly found in equal numbers in each of the three tows at the same time.

Paracalanus pygmaeus (Claus)

[*Calanus pygmaeus* Claus, Die freilebenden Copepoden, p. 174, 1863.]

Not found in the Atlantic plankton, but widely scattered in the Pacific with numerous long gaps in distribution. It was taken in 10 nocturnal and 11 diurnal surface tows, 26 50-meter tows, and 30 100-meter tows. These records, like those of *aculeatus*, suggest a species negative to strong light, which comes to the surface at night and stays there in the morning until the light becomes too strong, when it drops to the 50-meter and 100-meter depths. It has been reported from the North and South Atlantic and the Mediterranean, but this is the first record from the Pacific.

Genus **PAREUCHAETA** A. Scott, 1909

Pareuchaeta grandiremis (Giesbrecht)

[*Euchaeta grandiremis* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 337, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 246, 264, pl. 16, figs. 11, 42; pl. 37, fig. 41, 1892.]

A few specimens of this species were found in the 100-meter tow at station 24 in the tropical Atlantic, and this was the only record for the cruise. This species was originally obtained by Giesbrecht (1892, p. 246) from the eastern Pacific near the equator from a depth of 1000 meters, and this *Carnegie* record is the first from the tropical Atlantic.

Pareuchaeta incisa (G. O. Sars)

[*Euchaeta incisa* G. O. Sars, Bull. Mus. océanogr. Monaco, no. 26, p. 17, 1905.]

Four females of this species were captured in the vertical tow from a depth of 1000 meters at station 64 in the south-eastern Pacific. The species was obtained by Sars (1925, p. 117) from considerable depths in the temperate Atlantic and is probably a deep-water form which does not come above the 100-meter line in the daytime. It has not been recorded except by Sars, and all his specimens came from the temperate Atlantic.

Pareuchaeta tonsa (Giesbrecht)

[*Euchaeta tonsa* Giesbrecht, Bull. Mus. Comp. Zoöl., Harvard Coll., vol. 25, no. 12, Copepoda, p. 251, pl. 4, figs. 9, 10, 1895.]

This species appeared but four times in the *Carnegie* plankton hauls: twice in the Atlantic at the 50-meter level, at station 11 where it was abundant and at station 12 where a few were found, and twice in the Pacific, where it proved to be very scarce at the levels fished, for here only 3 females were captured, 2 in the 100-meter tow at station 147, and 1 in the 50-meter tow at station 141. This is apparently a deep-water form that occasionally gets above the 100-meter line. It may be recognized by the sharp points on either side of the last thoracic segment and by the form of the ventral projection of the genital segment. Sars (1925, p. 122) has recorded thirty-six localities for this species, two of them surface tows, the others vertical hauls from depths of 1000 to 5700 meters.

Pareuchaeta tumidula (G. O. Sars)

[*Euchaeta tumidula* G. O. Sars, Bull. Mus. océanogr. Monaco, no. 26, p. 15, 1905.]

A single female was taken in the 50-meter tow at station 40 in the eastern tropical region of the Pacific. This station was almost on the equator and close to the coast of Ecuador. This is the smallest species of the genus, and has not before been reported from the Pacific. Sars' (1925, p. 119) specimens all came from the temperate Atlantic in vertical hauls from 1000 to 3000 meters.

Genus **PENNELLA** Oken, 1816**Pennella** species

A free-swimming copepodid larva of some *Pennella* species was taken in the 100-meter tow at station 155. This was very similar to the description and figures of the copepodid larva of *Pennella varians* given by Wierzejski (1877, p. 572). But so little is known of the development of this genus that specific identification is impossible.

Genus **PHAENNA** Claus, 1863**Phaenna spinifera** Claus

[*Phaenna spinifera* Claus, Die freilebenden Copepoden, p. 189, pl. 31, figs. 1-7, 1863.]

This species was well scattered in both oceans, with numerous large gaps in distribution. It was taken in 7 surface tows, 22 50-meter tows, and 23 100-meter tows, and in the vertical tow from 1000 meters, station 64. It is thus negative to strong light, and did not appear in any of the nocturnal surface tows. It is easily recognized in side view by the highly vaulted cephalothorax and the absence of fifth legs in the female.

Genus **PHYLLOPUS** Brady, 1883**Phyllopus helgae** Farran

(Figure 89)

[*Phyllopus helgae* Farran, Fisheries, Ireland, Sci. Invest. for 1906, pt. 2, p. 83, pl. 9, figs. 5, 6, 1908.]

Three females were obtained in the vertical tow from a depth of 1000 meters at station 64 in the southeastern Pacific. This is a deep-water species which has been reported by Sars (1925, p. 342) and A. Scott (1909, p. 148) from moderate depths in the western Pacific. It is possible that deeper tows at other stations in the southeastern Pacific would have revealed its presence. The *Siboga* plankton contained a single male and female of this species from a depth of 700 meters.

Genus **PLEUROMAMMA** Giesbrecht, 1898

This genus is easily recognized by the circular pigmented light spot on one side or the other of the first thoracic segment. Its species are all negative to light, and not one of them was found at the surface in the daytime. Furthermore, only one of the species was at all well distributed or abundant; the other four were much scattered in location and greatly reduced in numbers. Steuer's (1932; 1933) excellent monograph on this genus shows that each of the species is much more abundant in the Atlantic and Indian oceans than in the Pacific.

Pleuromamma abdominalis (Lubbock)

[*Diaptomus abdominalis* Lubbock, Trans. Entomol. Soc. London, n. s., vol. 4, pt. 1, p. 22, pl. 10, 1856.]

Not found in the Atlantic plankton and at only a few localities in the Pacific, long distances apart. It was taken in 2 nocturnal surface tows and 6 100-meter tows, and in the

vertical tow from 1000 meters, station 64, but not in any 50-meter tow nor at the surface in the daytime. Although it comes to the surface at night, it descends to 100 meters or more by day and is thus negative to light. Steuer's (1932, p. 9; 1933, p. 5) distribution map shows this species as very abundant in the North Atlantic in deep water.

Pleuromamma gracilis (Claus)

[*Pleuromamma gracilis* Claus, Die freilebenden Copepoden, p. 197, pl. 5, 1863.]

Found once between stations 13 and 14 in the Atlantic, and widely scattered in the Pacific, with long gaps in distribution. It was taken in 12 nocturnal surface tows, 14 50-meter tows, and 30 100-meter tows, and in the vertical tow from 1000 meters at station 64. It was recorded as abundant in the single Atlantic surface tow and once in the Pacific at the surface, and as common three times. Therefore, it migrates to the surface in considerable numbers at night, although it was not found there at all during the day.

Pleuromamma quadrangulata (F. Dahl)

[*Pleuromamma quadrangulata* F. Dahl, Zool. Anz., vol. 16, no. 415, p. 105, 1893.]

A single female of this species was present in the 100-meter tow at station 49 in the southeastern Pacific, and this was the only record for the cruise. This species was said by Esterly (1912, p. 315) to be "rather common in all the deeper hauls" off the California coast at San Diego. But he added, "none taken above 170 fathoms." This suggests that, having been found in the southeastern Pacific, it may be more common there below 100 meters than would be inferred from this single specimen. Steuer's (1932, p. 26; 1933, p. 14) distribution map shows this species to be distinctly tropical in habitat.

Pleuromamma robusta (F. Dahl)

(Figure 98)

[*Pleuromamma robustum* F. Dahl, Zool. Anz., vol. 16, no. 415, p. 105, 1893.]

Three specimens of this species were taken in the vertical tow from a depth of 1000 meters at station 64, and it was found in the 100-meter tows at six other Pacific stations. A few individuals also occurred in one 50-meter tow, but none were found at the surface either by day or by night. This species has been reported by Farran (1929, p. 260) as common in a small area south of New Zealand in the Pacific. Steuer (1932, p. 20; 1933, p. 11) recorded it from the Antarctic south of Africa, but as much more abundant in the tropical and northern Atlantic.

Pleuromamma xiphias (Giesbrecht)

[*Pleuromamma xiphias* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 2, p. 25, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 347, 357, pl. 32, fig. 14; pl. 33, figs. 42, 45, 50, 1892.]

Taken in a nocturnal surface tow between stations 20 and 21 in the Atlantic, and in the vertical tow from a depth of

1000 meters at station 64 in the southeastern Pacific. It was reported by Farran (1929, p. 260) in a nocturnal surface tow off New Zealand, and hence migrates to the surface at night. In the daytime it probably remains below 100 meters, which accounts for its scarcity in the *Carnegie* plankton. Steuer (1932, p. 5; 1933, p. 3) recorded this species as abundant in the tropical and temperate Atlantic.

Genus PONTELLA Dana, 1846

This genus is widely scattered in both oceans, but with a single exception the localities are far apart and the specimens are very few. All the species frequent the surface and are rarely found in either of the deeper tows. They are moderately large, with a hook on each lateral margin of the head, a single pair of dorsal eye lenses, and a lens at the base of the rostrum for the ventral eye. They are usually found in temperate and tropical regions, but occasionally farther north or south.

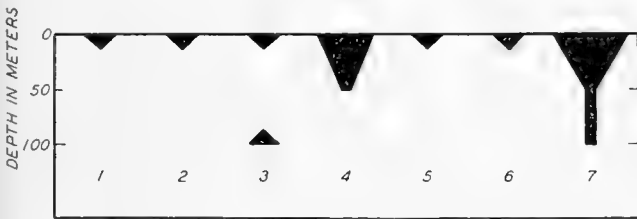


CHART 14. Daytime vertical distribution of species of *Pontella*: (1) *atlantica*, (2) *cristata*, (3) *danae*, (4) *lobiancoi*, (5) *princeps*, (6) *securifer*, (7) *tenuiremis*. Four of the species were confined to the surface tows, one appeared both at the surface and in the 100-meter tow, one was confined to the two upper tows, and one was present at all three depths, but these last two were far more abundant at the surface. This, therefore, may fairly be called a surface genus, the stragglers found in the two deeper tows only emphasizing the greater abundance at the surface.

Pontella atlantica (H. Milne Edwards)

[*Pontia atlantica* H. Milne Edwards, Hist. nat. Crust., vol. 3, p. 420, pl. 39, 1840.]

Found at one station (32) in the Caribbean Sea and at four localities in the Pacific. One of the latter was a nocturnal surface tow, and all the others were diurnal surface tows. It evidently remains consistently at the surface during the entire 24 hours of the day and takes no part in vertical migrations.

Pontella cristata Krämer

[*Pontella cristata* Krämer, Zool. Jahrb., Abth. Syst., vol. 9, p. 721, figs. 1, 4-6, 8, 9, 1896.]

Not found in the Atlantic plankton, but present at four localities in the central Pacific, all the specimens coming from surface tows in the daytime. The species was originally obtained by Krämer (1896, p. 720) from a little farther south in the Pacific near New South Wales, Australia. As its specific name suggests, it is distinguished by a low crest on the head.

Pontella danae Giesbrecht

[*Pontella danae* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 2, p. 28, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 461, 477, pl. 24, fig. 40; pl. 40, figs. 16, 20, 1892.]

Not found in the Atlantic plankton, and in the Pacific confined to the southeastern part. It was present in 1 nocturnal and 5 diurnal surface tows, and 1 100-meter tow, but not in any 50-meter tow. The urosome is very asymmetrical, the right caudal ramus is exceptionally enlarged, and the lens of the ventral eye at the base of the rostrum is almost spherical. This species has not thus far been reported outside the Pacific Ocean.

Pontella lobiancoi (Canu)

(Figure 94)

[*Pontellina lobiancoi* Canu, Bull. sci. France et Belgique, vol. 19, p. 102, pls. 8, 9, 1888.]

Found at three localities in the Atlantic and five in the Pacific. One of the former was a nocturnal surface tow, the others, with one exception, being diurnal surface tows. The exception was a 50-meter tow at station 91, which yielded a larger number of individuals of this species than any other single locality. This would seem to suggest that the species is positive to ordinary light but becomes negative to strong light.

Pontella pennata Wilson

[*Pontella pennata* Wilson, Proc. U. S. Nat. Mus., vol. 80, art. 15, p. 27, pl. 1, 1932a.]

A single female was obtained from the surface tow at station 1 in the Atlantic, and this was the only record for the cruise. Thus far this species has been found only in the North Atlantic not far distant from the American coast. All specimens ever taken were in surface tows, indicating that the species is positive to light.

Pontella princeps Dana

[*Pontella princeps* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 34, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1168, 1853; pl. 82, fig. 4a-c, 1855.]

Not found in the Atlantic plankton, and in the Pacific confined to eight localities in the southeastern region. It was present in 2 nocturnal and 6 diurnal surface tows and did not appear in either of the two deeper tows. Like *atlantica*, it apparently remains at the surface both day and night. The left side of the urosome has outgrowths which render it quite asymmetrical. The species has been reported from the Indian Ocean and from the tropical Pacific, but has not been found in the Atlantic.

Pontella securifer Brady

[*Pontella securifer* Brady, Voyage of H.M.S. Challenger, Zool., vol. 8, pt. 23, Copepoda, p. 96, pl. 45, 1883.]

Found at one station (34) in the Caribbean Sea and at five localities in the Pacific, very widely scattered. All the specimens were obtained in surface tows, one of which was noc-

turnal, the others diurnal. This, then, is a fifth species which remains at the surface during the day and night and does not descend to lower depths. All the *Siboga* specimens were taken in surface tows with the exception of 2 specimens which were captured in a vertical haul.

***Pontella tenuiremis* Giesbrecht**

(Figures 93, 97)

[*Pontella tenuiremis* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 2, p. 28, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 462, 477, pl. 24, figs. 24-26; pl. 40, figs. 3, 4, 7, 37, 1892.]

Not present in the Atlantic plankton, but well distributed in the southeastern and central Pacific. It was taken in 5 nocturnal and 27 diurnal surface tows, 1 50-meter tow, and 1 100-meter tow. It is evidently positive to ordinary light but may become negative to strong light. The genital segment has a flattened genital swelling and a small process on the right side behind it.

Genus **PONTELLINA** (Dana), 1853

***Pontellina plumata* (Dana)**

(Figure 100)

[*Pontella plumata* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 27, 1849.]

[*Pontellina plumata* Dana, U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, pp. 1135, 1136, 1853; pl. 79, fig. 10a-d, 1855.]

Well distributed in both oceans, except in the northern regions and in the southern part of the Pacific. It was taken in 8 nocturnal and 33 diurnal surface tows, 37 50-meter tows, and 28 100-meter tows. It is thus almost indifferent to light, but slightly favors the two upper tows. It is very generally distributed in the warm regions of all oceans, but rarely occurs in abundance anywhere. Thirty-four of the present abundance records were solitary specimens and twenty-five others were expressed in numerals.

Genus **PONTELLOPSIS** Brady, 1883

***Pontellopsis armata* (Giesbrecht)**

[*Monops armatus* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 2, p. 28, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 487, 496, pl. 26, figs. 19, 26, 27; pl. 41, figs. 46, 47, 58, 1892.]

Two females of this species were obtained in the surface tow at station 98, and this is the only record for the cruise. This species was reported by A. Scott (1909, p. 170) as "the most abundant member of the genus" in the *Siboga* plankton. It is worthy of note that, with one exception, the *Siboga* specimens were obtained at the surface. It seems reasonable, therefore, to record the species as positive to light.

***Pontellopsis lubbockii* (Giesbrecht)**

[*Monops lubbockii* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 2, p. 29, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 487, 496, pl. 26, figs. 18, 32; pl. 41, figs. 60, 63, 68, 1892.]

About a dozen specimens, including 1 male and 2 adult females and the remainder development stages, were taken at the surface at station 40. This is the only record for the cruise, but the species has been reported before from the tropical Pacific. The long process, enlarged at the tip, at the right posterior corner of the last thoracic segment in the male is a distinguishing character.

***Pontellopsis perspicax* (Dana)**

(Figure 99)

[*Pontella perspicax* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 32, 1849.]

[*Pontellina perspicax* Dana, U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1155, 1853; pl. 81, fig. 2a-d, 1855.]

Not present in the Pacific plankton, but found at six surface stations in the tropical Atlantic. The structure of the fifth legs in both sexes will serve to distinguish the species.

***Pontellopsis regalis* (Dana)**

(Figures 88, 92)

[*Pontella regalis* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 31, 1849.]

[*Pontellina regalis* Dana, U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1154, 1853; pl. 81, fig. 1a, b, 1855.]

Found at two stations in the tropical Atlantic south of the Sargasso Sea and at four in the eastern tropical Pacific. All the specimens were taken at the surface. This is the largest species of the genus and may be recognized by the structure of the fifth legs.

***Pontellopsis villosa* Brady**

(Figure 91)

[*Pontellopsis villosa* Brady, Voyage of H.M.S. Challenger, Zool., vol. 8, pt. 23, Copepoda, p. 86, pl. 34, figs. 10-13; pl. 35, figs. 14-20, 1883.]

A few specimens, including both sexes, were taken in the surface tow at station 144, in the Pacific north of the Hawaiian Islands, and this was the only record for the cruise. This was Brady's (1883, p. 86) original species which he made the type of a new genus, *Pontellopsis*. His specimens were obtained by the *Challenger* expedition in almost exactly the same locality as the *Carnegie* specimens, but fifty years before.

Genus **PSEUDOCALANUS** Boeck, 1872

***Pseudocalanus gracilis* G. O. Sars**

[*Pseudocalanus gracilis* G. O. Sars, Crustacea of Norway, vol. 4, p. 154, suppl. pl. 1, 1903.]

Two females were found in the surface tow at station 46 in the eastern Pacific, and this was the only record for the cruise. The number of specimens is far too small to warrant any general conclusions. With (1915, p. 57) considers this species a synonym of *P. minutus*.

Pseudocalanus minutus (Krøyer)

[*Calanus minutus* Krøyer, Naturhist. Tidsskr., Kjöbenhavn, ser. 2, vol. 2, p. 543, 1848.]

This species is easily second in abundance and distribution to *Oithona similis*. It was found, with few exceptions, at every locality in both oceans. It was taken in 42 nocturnal and 88 diurnal surface tows, 116 50-meter tows, and 106 100-meter tows. It was repeatedly found evenly distributed in all three tows at the same time. It would seem, therefore, that it is more or less indifferent to ordinary light but may become somewhat negative to strong light.

Genus **PSEUDOCHIRELLA** G. O. Sars, 1920

Pseudochirella divaricata (G. O. Sars)

[*Gaidius divaricata* G. O. Sars, Bull. Mus. océanogr. Monaco, no. 26, p. 10, 1905.]

A single female was taken in the vertical tow from a depth of 1000 meters at station 64 in the southeastern Pacific, and this was the only record for the cruise. Since all the specimens thus far obtained have come from considerable depths, this species might possibly have been obtained in other localities if the tows had descended far enough below the 100-meter level.

Genus **RHINCALANUS** Dana, 1853

Rhincalanus cornutus Dana

[*Rhincalanus cornutus* Dana, U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1083, 1853; pl. 76, fig. 1a, b, 1855.]

This species was well dispersed in both oceans, but with several extensive gaps in its distribution. It was taken in 6 surface tows, 26 50-meter tows, and 23 100-meter tows. It is thus negative to strong light, but it may be more or less indifferent to weak light and thus linger at the surface in dull weather.

Rhincalanus nasutus Giesbrecht

(Figure 114)

[*Rhincalanus nasutus* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 334, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 152, 160, pl. 3, fig. 6; pl. 9, figs. 6, 14; pl. 12, figs. 9-12, 14, 16, 17; pl. 35, figs. 46, 47, 49, 1892.]

This species was a trifle less evenly distributed than the preceding one, and there were even more extensive gaps in the Pacific distribution. It was taken in 6 surface tows, 19 50-meter tows, and 21 100-meter tows. It thus bears the same relation to light as *cornutus*, from which it can be distinguished by the fact that the rostral filaments are invisible in dorsal view, whereas they can be seen plainly on either side of the head in *cornutus*.

Genus **SAPPHIRINA** J. V. Thompson, 1830

This genus includes species which are nearly transparent and strongly depressed, with lamellar caudal rami and a pair

of eye lenses on the forehead. They were not found in the northern part of either ocean or at the three southern stations in the Pacific. The majority of them show a preference for the two deeper tows, but one manifests a definite preference for the surface and another is about equally distributed at all three depths. Several were obtained in such small numbers as to warrant no conclusions.



CHART 15. Vertical distribution of certain species of *Sapphirina*: (1) *angusta*, (2) *auronitens*, (3) *darwinii*, (4) *metallina*, (5) *nigromaculata*, (6) *opalina*, (7) *ovatolanceolata*, (8) *pyrosomatis*, (9) *salpae*. One species was confined to the 50-meter tow and one to the 100-meter tow. Two others were confined to the two upper tows, and the remaining five appeared at all three depths. One of these latter was most abundant at the surface, one in the 100-meter tow, and three in the 50-meter tow. The species of this genus, therefore, differ nearly as much in their vertical distribution as they do in their specific characters.

Sapphirina angusta Dana

[*Sapphirina angusta* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 41, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1240, 1853; pl. 87, fig. 3a, b, 1855.]

About equally distributed in both oceans, with several extensive gaps in the Pacific dispersal. It was present in 5 nocturnal and 14 diurnal surface tows, 15 50-meter tows, and 13 100-meter tows. The daytime distribution was thus practically equal at all three depths, and the species manifested no preference for any one of them. Twenty-one of the records were single specimens, and it is worthy of note that all the nine records of this species in the *Siboga* plankton were also single specimens.

Sapphirina auronitens Claus

[*Sapphirina auronitens* Claus, Die freilebenden Copepoden, p. 153, 1863.]

This was the most abundant species of the genus, chiefly in the Pacific plankton. It was taken in 16 nocturnal and 55 diurnal surface tows, 33 50-meter tows, and 29 100-meter tows. The species thus shows a preference for the surface,

even without the nocturnal tows, but the attraction cannot be very strong since so many are left in the deeper tows.

Sapphirina darwinii Haeckel

[*Sapphirina darwinii* Haeckel, Ztschr. f. Med. u. Naturwiss., Jena, vol. 1, p. 105, pls. 2, 3, 1864.]

A few specimens were found in a nocturnal 50-meter tow between stations 1 and 2 in the Atlantic, and this is the only record for the cruise. In the *Siboga* plankton this species was captured twice at night, twice in vertical tows from considerable depths, and twice at the surface. It is possible that deeper tows might have revealed it at some of the Pacific stations.

Sapphirina metallina Dana

(Figure 111)

[*Sapphirina metallina* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 41, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1242, 1853; pl. 87, fig. 5a-c, 1855.]

Not found in the Atlantic plankton, and in the Pacific confined chiefly to the western and central regions. It was taken in 1 surface tow, 11 50-meter tows, and 24 100-meter tows. It thus shows definite aversion to light, and in the *Siboga* plankton was found four times in vertical tows from considerable depths. The two inner terminal setae on each caudal ramus are leaflike, with a wide transparent blade on either side of the central shaft.

Sapphirina nigromaculata Claus

[*Sapphirina nigromaculata* Claus, Die freilebenden Copepoden, p. 152, pl. 8, 1863.]

Found at eight Atlantic localities, and in the Pacific more numerous in the southeastern and western regions. It was taken in 2 nocturnal and 17 diurnal surface tows, 37 50-meter tows, and 33 100-meter tows. It is, therefore, negative to light, but comes to the surface at night and is often found there in the daytime.

Sapphirina opalina Dana

(Figure 112)

[*Sapphirina opalina* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 45, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1254, 1853; pl. 88, fig. 4a-l, 1855.]

Not found in the Atlantic plankton, but present in each of the Pacific regions except the northern, although very widely scattered. It was taken in 2 nocturnal and 3 diurnal surface tows, 13 50-meter tows, and 10 100-meter tows. This species is also negative to light, coming to the surface at night, and being rarely found there in the daytime.

Sapphirina ovatolanceolata Dana

(Figure 110)

[*Sapphirina ovatolanceolata* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 44, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1251, 1853; pl. 87, figs. 15a-c, 16a, b, 1855.]

Not found in the Atlantic plankton, and confined to two localities in the Pacific, one in the eastern and the other in the western tropical region. At the western station it was taken in a daytime surface tow, and at the eastern station in a nocturnal 50-meter tow. The *Siboga* expedition found this species generally distributed in the Malay Archipelago and elsewhere in the tropical Pacific.

Sapphirina pyrosomatis Giesbrecht

[*Sapphirina pyrosomatis* Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, pp. 619, 641, pl. 52, figs. 12-14, 17; pl. 53, figs. 8, 41, 53; pl. 54, figs. 21, 38, 58, 1892.]

Not found in the Atlantic plankton, and confined to three localities in the southeastern Pacific, all three records being single specimens. It was taken at the surface, once in the night and once in the daytime, and once in the 50-meter tow. Apparently this is the first record from the Pacific Ocean, as it has been reported hitherto only from the Atlantic and Mediterranean.

Sapphirina salpae Claus

(Figure 109)

[*Sapphirina salpae* Claus, Arch. f. Anat., Physiol., wissenschaft. Med., Jahrg. 1859, p. 270, 1859.]

Not found in the Atlantic plankton, but present at four widely separated localities in the Pacific. It was taken once in a nocturnal surface tow and three times in 100-meter tows. Therefore, as far as this meager collection shows, the species is negative to light and comes to the surface at night. Farran (1929, p. 287) recorded it as "frequent off New Zealand," where it was captured at the surface mostly in the night but rarely in the daytime.

Sapphirina scarlata Giesbrecht

[*Sapphirina scarlata* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 478, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 620, 642, pl. 52, figs. 42, 60, 61; pl. 53, figs. 12, 39, 62; pl. 54, figs. 25, 31, 72, 1892.]

Found at a single station (34) in the Caribbean Sea, and at four localities in the Pacific. It was taken in 1 diurnal surface tow, 2 50-meter tows, and 2 100-meter tows. This meager record suggests aversion to light. This species was reported by Farran (1929, p. 289) off New Zealand in the *Terra Nova* expedition, but only a few specimens were taken.

Sapphirina stellata Giesbrecht

[*Sapphirina stellata* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 478, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 620, 643, pl. 52, figs. 7-9; pl. 53, figs. 15, 35, 59; pl. 54, figs. 22, 27, 69, 1892.]

Found at three Atlantic and five Pacific localities, the latter all in the western region. It was taken in 1 nocturnal and 4 diurnal surface tows, 1 50-meter tow, and 3 100-meter tows. A. Scott (1909, p. 259) reported this as the most common and widely distributed species of the genus in the

Siboga plankton, and most of the specimens were taken at the surface either at night or in the daytime.

Genus **SCAPHOCALANUS** G. O. Sars, 1900

Scaphocalanus elongatus A. Scott

(Figure 113)

[*Scaphocalanus elongatus* A. Scott, Copepoda of Siboga Exped., vol. 29a, pt. 1, p. 98, pl. 32, figs. 10-16, 1909.]

A single female was obtained in the 100-meter tow at station 107 in the western tropical Pacific, and this was the only record for the cruise. The specimen which A. Scott (1909, p. 98) described under the above name was taken not far from the same locality. Since the *Siboga* and *Carnegie* planktons each yielded but a single specimen, the species must be quite rare.

Scaphocalanus magnus (T. Scott)

[*Amalophora magna* T. Scott, Trans. Linn. Soc. London, ser. 2, Zool., vol. 6, pt. 1, p. 55, pl. 6, figs. 5-9, 1894.]

A single female was obtained in the vertical tow from a depth of 1000 meters at station 64 in the southeastern Pacific. It is easily distinguished by the helmet-shaped crest on the forehead and the structure of the fifth legs. Half the specimens obtained in the *Siboga* plankton were found in vertical tows from considerable depths, and the other half in surface tows at night. It thus seems probable that this is a deep-water species remaining below 100 meters in the daytime.

Scaphocalanus medius (G. O. Sars)

(Figure 136)

[*Amalophora media* G. O. Sars, Bull. Inst. océanogr. Monaco, no. 101, p. 16, 1907.]

A single female was taken in the 100-meter tow at station 56 in the southeastern Pacific. This is another deep-water species, and has been found in both oceans, but probably remains below 100 meters most of the time. It has no crest, and the structure of the fifth legs is quite different from that in the other two species of the genus.

Genus **SCOLECITHRICELLA** G. O. Sars, 1902

This genus is distinguished from *Scolecithrix* by the presence of a fifth pair of legs in the female as well as the male.

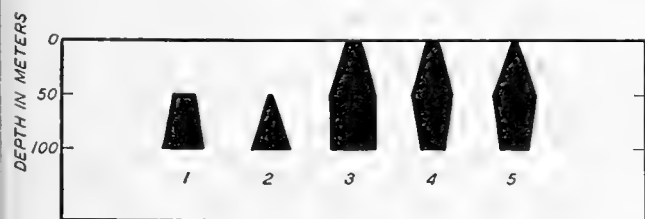


CHART 16. Daytime vertical distribution of certain species of *Scolecithricella*: (1) *abyssalis*, (2) *auropecten*, (3) *bradyi*, (4) *marginata*, (5) *minor*.

Scolecithricella abyssalis (Giesbrecht)

(Figures 120, 132)

[*Scolecithrix abyssalis* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 338, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 266, 284, pl. 13, figs. 15, 40; pl. 37, fig. 7, 1892.]

Not found in the Atlantic plankton, and in the Pacific virtually confined to the eastern and central tropical regions. It was taken in 3 50-meter tows and 7 100-meter tows, but in none of the surface tows either by day or by night. This makes the species negative to light and furnishes no evidence with regard to nocturnal migration. As in the *Siboga* plankton, all the specimens found were females and the male is still unknown. The species has been reported from the Faroe Channel in the North Atlantic.

Scolecithricella auropecten (Giesbrecht)

(Figure 121)

[*Scolecithrix auropecten* Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, pp. 266, 284, pl. 13, figs. 8, 18, 22, 27; pl. 37, figs. 3, 10, 1892.]

Not found in the Atlantic plankton, and in the Pacific segregated in the southeastern and central regions. It was taken in 1 50-meter tow and 5 100-meter tows, and in the vertical tow from 1000 meters, station 64, but did not appear at all at the surface. As in the case of *abyssalis*, this makes the species negative to light and gives no evidence of nocturnal migration. The long aesthetascs on the first antennae were very noticeable and looked like strings tied to a wire. The 2 specimens in the *Siboga* plankton were taken in vertical hauls from depths of 900 and 1000 meters.

Scolecithricella bradyi (Giesbrecht)

[*Scolecithrix bradyi* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 337, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 266, 283, pl. 4, fig. 7; pl. 13, figs. 1, 3, 7, 11, 21, 28; pl. 37, figs. 1, 2, 9, 1892.]

Not present in the Atlantic plankton, but well distributed in the Pacific, especially the southeastern and western regions. It was taken in 8 nocturnal and 2 diurnal surface tows, 18 50-meter tows, and 18 100-meter tows, and at station 64 in the vertical tow from 1000 meters. This record gives good evidence of nocturnal migration to the surface and a return to the deeper layers in the daytime. The fifth legs of the female are so small as to be easily overlooked unless carefully searched for, but in the male they are fairly large and prehensile. In the *Siboga* plankton 5 specimens were taken in vertical hauls from depths of 750 to 1500 meters, and 1 at the surface at night.

Scolecithricella marginata (Giesbrecht)

(Figures 122, 133)

[*Scolecithrix marginata* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 338, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 266, 285, pl. 13, figs. 10, 31, 1892.]

Not found in the Atlantic plankton, but at a few localities

in the eastern Pacific and a few others in the central part north of the Samoan Islands. It was taken in 2 nocturnal and 2 diurnal surface tows, 6 50-meter tows, and 3 100-meter tows. The *Carnegie* specimens seemed to prefer the 50-meter depth, and this was the only tow in which they were recorded as abundant. Half the *Siboga* specimens were obtained at the surface, some in the daytime and some at night, and the other half were taken in vertical hauls from considerable depths.

***Scolecithricella minor* (Brady)**

(Figures 124, 126, 130)

[*Scolecithrix minor* Brady, Voyage of H.M.S. Challenger, Zool., vol. 8, pt. 23, Copepoda, p. 58, pl. 16, figs. 15, 16, pl. 18, figs. 1-5, 1883.]

Found at three stations in the Atlantic and in widely scattered localities in the Pacific. It was taken in 1 surface tow, 8 50-meter tows, and 6 100-meter tows. These few specimens showed a preference for the 50-meter depth and gave no evidence as to nocturnal migration. This species has been reported from the North and South Atlantic and the Indian Ocean, but this is the first record from the Pacific Ocean.

***Scolecithricella ovata* (Farran)**

(Figure 125)

[*Scolecithrix ovata* Farran, Ann. Rept. Fisheries, Ireland, 1902-03, pt. 2, app. 2, p. 37, pl. 6, figs. 13-18; pl. 7, figs. 1-7, 1905.]

A few specimens were found in the 100-meter tow at station 9 in the northern Atlantic, southwest of Iceland, and this was the only record for the cruise. The species was reported from the same locality by With (1915, p. 208), and Farran's (1905, p. 37) original specimens came from the west coast of Ireland. Pearson (1906, p. 18) gave the vertical range as 382 fathoms, which makes it a deep-water species not likely to be obtained in the upper 100 meters. This seems to be a typical Atlantic species and has not as yet been found anywhere else.

***Scolecithricella porrecta* (Giesbrecht)**

(Figures 127, 134)

[*Scolecithrix porrecta* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 338, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 266, 285, pl. 13, figs. 6, 41; pl. 37, fig. 11, 1892.]

Not found in the Atlantic plankton, and in the Pacific confined chiefly to the region north of 40° north latitude. It was taken in 3 50-meter tows and 5 100-meter tows, but was not found at the surface either by day or by night. The female is distinguished by the exceptionally long spine on the inner margin of the fifth legs. Giesbrecht's (1888, p. 338; 1892, p. 266) original specimens, on which the species was founded, came from the eastern Pacific just south of the equator, at a depth of 1800 meters, and it has not been reported from any other locality.

***Scolecithricella spinacantha*, new species**

(Figures 103-108)

Occurrence. A few females were found in the 50-meter tows at stations 158 and 159, just north of the Samoan Islands in the tropical Pacific. In company with the adults were some juveniles which had not developed beyond the early copepodid stages, and lacked the fifth legs.

Description of female. Metasome elongate-ovate, strongly narrowed anteriorly and more bluntly rounded posteriorly. Head fused with first segment and the two nearly one-half longer than the free thorax and widest across the posterior margin. Fifth segment also fused with fourth, its posterior corners bluntly rounded and projecting slightly backward. Urosome about one-fifth as wide and one-fourth as long as metasome and four-segmented. The genital segment is a little less than half the length of the urosome and slightly wider than the abdomen, with nearly straight sides. The three abdominal segments are about equal in length but diminish in width posteriorly; the anal segment is somewhat triangular, longest on the mid-line and considerably shortened on the lateral margins, leaving the posterior corners obliquely truncated. The caudal rami are about as wide as long, and divergent, each with four long setae, the second inner one longer than the entire urosome.

The rostrum is composed of two short, stout filaments attached to a projection on the forehead, with no cilia visible at their tips. The first antennae are slender and reach to about the middle of the abdomen; the second antennae and mouth parts are similar to those of other species of the genus except that the teeth on the chewing blade of the mandibles are longer, more slender, and very unequal in length. They resemble needles or attenuated spines far more than they do ordinary teeth.

The first four pairs of swimming legs have three-segmented exopods, and the endopods are one-, two-, three-, and three-segmented respectively. The first and fourth legs have no spines on their posterior surfaces that can be detected, but the second and third legs are covered rather sparsely on the posterior surface with small spines not definitely arranged. The fifth legs are very characteristic and give rise to the specific name; each consists of a single segment and a basal part. The segment is tipped with a short and stout conical spine, inside the base of which at the inner distal corner is another stout spine five or six times as long as the terminal one, with a row of short cilia along its dorsolateral surface. On the outer margin of the segment, just beyond its center, is a large projecting lobe, which, together with the distal outer margin of the segment itself, is fringed with coarse, flattened spines. The distal margin of the lobe, as it curves around to join the side of the segment, forms a sort of sinus which strongly suggests that the segment is really made up of two segments fused. But a careful examination gave no evidence of division on either surface of the leg or in the arrangement of the inner musculature.

Total length, 1.05 mm; length of metasome, 0.87 mm; width, 0.42 mm.

Type. U. S. Nat. Mus. no. 64005.

Remarks. This is the smallest of the *Scolecithricella* species here considered, and may be differentiated by its size alone. The fifth legs are very different from those of any species hitherto described and furnish the distinguishing character of the species. From the fact that the development stages, as well as the adults, were at the 50-meter level at both stations, it would seem that the species is probably negative to light.

Genus **SCOLECITHRIX** Brady, 1883

Scolecithrix danae (Lubbock)

[*Undina danae* Lubbock, Trans. Entomol. Soc. London, n. s., vol. 4, p. 21, pl. 9, figs. 6-9, 1856.]

This species was very liberally distributed in both oceans except in the northern regions. It was taken in 8 nocturnal and 8 diurnal surface tows, 80 50-meter tows, and 63 100-meter tows, and in the vertical tow from 1000 meters, station 64. It thus shows a definite aversion to light and gives good evidence of migration to the surface at night.

Genus **SPINOCALANUS** Giesbrecht, 1888

Spinocalanus abyssalis Giesbrecht

[*Spinocalanus abyssalis* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 335, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, p. 209, pl. 13, figs. 42-48; pl. 36, fig. 49, 1892.]

Found at three stations in the tropical Atlantic and at many Pacific localities, chiefly in the southeastern region. It was taken in 5 nocturnal and 2 diurnal surface tows, 11 50-meter tows, and 14 100-meter tows. It is thus negative to light and gives proof of migration to the surface at night. Giesbrecht's original specimens (1888, p. 335) came from the tropical Pacific from depths of 1000 to 4000 meters.

Spinocalanus caudatus G. O. Sars

[*Spinocalanus caudatus* G. O. Sars, Bull. Inst. océanogr. Monaco, no. 377, p. 3, 1920.]

Not found in the Atlantic plankton, but present in very small numbers in the southeastern and central Pacific. It was taken in 1 nocturnal and 1 diurnal surface tow, 3 50-meter tows, and 2 100-meter tows. These few specimens preferred the two deeper tows, and one of them had come to the surface at night.

Spinocalanus magnus Wolfenden

[*Spinocalanus magnus* Wolfenden, Jour. Marine Biol. Assoc., n. s., vol. 7, p. 118, 1904.]

Not found in the Atlantic plankton, but captured at five localities in the central Pacific. It was taken in 1 nocturnal surface tow, 2 50-meter tows, and 1 100-meter tow. The number of specimens in the 100-meter tow was larger than that in the other four combined. Wolfenden's (1904, p. 118) original specimens came from the North Atlantic, and he afterward found the same species in the *Gauss* plankton from the Antarctic.

Genus **TEMORA** Baird, 1850

Temora discaudata Giesbrecht

(Figures 115, 118)

[*Temora discaudata* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 5, sem. 1, p. 814, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 328, 338, pl. 17, figs. 3, 20, 23; pl. 38, figs. 24, 25, 28, 1892.]

Not found in the Atlantic plankton, and in the Pacific confined chiefly to the eastern and southeastern regions. It was taken in 3 nocturnal and 13 diurnal surface tows, 7 50-meter tows, and 10 100-meter tows. This distribution indicates more or less indifference to light, with a slight preference for the surface. The strongly asymmetrical caudal rami are the chief specific characteristics.

Temora longicornis (Müller)

[*Cyclops longicornis* O. Fr. Müller, Entomostraca, p. 115, pl. 19, figs. 7-9, 1785.]

More abundant and more widely distributed in the Atlantic plankton than in the Pacific. It was present in 3 nocturnal and 6 diurnal surface tows, 6 50-meter tows, and 6 100-meter tows. Excluding the night tows, the vertical distribution is exactly even at the three depths, but the abundance records are somewhat larger in the 50-meter tows. The caudal rami are much narrower than in the preceding species, and strictly symmetrical.

Temora stylifera (Dana)

[*Calanus stylifer* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 13, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1058, 1853; pl. 72, fig. 9, 1855.]

Segregated in both oceans at certain localities long distances apart, and more abundant than either of the other two species. It was taken in 2 nocturnal and 14 diurnal surface tows, 11 50-meter tows, and 8 100-meter tows. It thus shows a slight preference for the surface, but the abundance records at the three depths are practically equal.

Genus **TEMOROPIA** T. Scott, 1894

Temoropia mayumbaensis T. Scott

(Figures 116, 117)

[*Temoropia mayumbaensis* T. Scott, Trans. Linn. Soc. London, ser. 2, Zool., vol. 6, pt. 1, p. 79, pl. 8, figs. 48, 49; pl. 9, figs. 1-12, 1894.]

A few specimens, including both sexes, were found in the 100-meter tow at stations 35 and 152 in the eastern and central Pacific, respectively. This species was originally described by T. Scott (1894, p. 79) from specimens taken in the Gulf of Guinea, but it has been reported from the Pacific by A. Scott (1909, p. 119) and Farran (1929, p. 257). Nearly all the *Siboga* specimens were obtained in vertical hauls from considerable depths, which suggests that this is a deep-water species, coming above the 100-meter level only occasionally.

Genus **UNDEUCHAETA** Giesbrecht, 1888**Undeuchaeta major** Giesbrecht

[*Undeuchaeta major* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 335, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 227, 232, pl. 37, figs. 56, 57, 59, 1892.]

Not found in the Atlantic plankton, but present at five localities in the Pacific. Three of these were nocturnal surface tows, 1 was at 100 meters, and 1 was in the vertical tow from 1000 meters at station 64; the species is thus negative to light but migrates to the surface at night. It was originally obtained from the Pacific and afterward from the North Atlantic, but is not abundant anywhere.

Undeuchaeta plumosa (Lubbock)

[*Undina plumosa* Lubbock, Trans. Entomol. Soc. London, n. s., vol. 4, pt. 1, p. 24, 1856.]

Not found in the Atlantic plankton, but taken in the Pacific in 2 nocturnal and 2 diurnal surface tows, 3 100-meter tows, and the vertical tow from 1000 meters at station 64. It is known to be a deep-water species, which evidently migrates to the surface at night and sometimes remains there into the forenoon if the light is weak, but usually migrates at least to the 100-meter level in the daytime.

Genus **UNDINOPSIS** G. O. Sars, 1884**Undinopsis bradyi** G. O. Sars

(Figure 135)

[*Undinopsis bradyi* G. O. Sars, in J. Spaare Schneider, Rept. Invertebrata from the Kvaenangen Fjord, Tromsø Mus. Aarsh., no. 7, p. 131, 1884.]

A single male was obtained in the 100-meter tow at station 56 in the southeastern Pacific, and this was the only record for the cruise. Only 3 specimens were obtained in the *Siboga* plankton, and they were captured in two vertical hauls from depths of 750 and 1500 meters. This is probably a deep-water copepod which does not get up to the 100-meter level very often in the daytime. Sars (1902, p. 32) stated that it was always found close to the bottom and that a light dredge must be used to capture it.

Genus **UNDINULA** A. Scott, 1909**Undinula caroli** (Giesbrecht)

[*Calanus caroli* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 331, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, pp. 91, 127, pl. 8, fig. 36, 1892.]

Not found in the Atlantic plankton, but present in all the regions of the Pacific except the northern. It was taken in 9 nocturnal and 3 diurnal surface tows, 25 50-meter tows, and 19 100-meter tows. It is thus negative to light and migrates to the surface at night. The males can be distinguished from those of *darwinii* by the structure of the fifth legs, but the females are so similar to those of *darwinii* that they can be separated from the latter only by the most careful examination. A. Scott (1909, p. 18) is therefore probably right when

he suggests that this difficulty in distinguishing the species is the reason why it has not been recorded in larger numbers.

Undinula darwinii (Lubbock)

(Figure 119)

[*Undina darwinii* Lubbock, Trans. Linn. Soc. London, vol. 23, p. 179, pl. 29, figs. 4, 5, 1863.]

Not found in the Atlantic plankton, but occurred at nearly every locality in the Pacific except in the northern part. It was taken in 28 nocturnal and 14 diurnal surface tows, 71 50-meter tows, and 73 100-meter tows, and in the vertical tow from 1000 meters at station 64. It is thus negative to light and migrates regularly to the surface at night. With most copepod species, when the sexes are unequal in size the smaller sex arranges itself above the larger, but in this species the larger females are found more often and in greater numbers at the surface and in the 50-meter tow, and the smaller males congregate at a lower level.

Undinula vulgaris (Dana)

[*Undina vulgaris* Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 22, 1849; U. S. Exploring Exped., 1838-1842 (Wilkes), vol. 14, pt. 2, Crustacea, p. 1092, 1853; pl. 77, fig. 8a-d, 1855.]

More widely distributed in the Atlantic than in the Pacific plankton. It was taken in 8 nocturnal surface tows, in which it was more abundant than in any of the diurnal tows. In the daytime it was present in 11 surface tows, 23 50-meter tows, and 16 100-meter tows. Like the preceding species, it is negative to light and migrates to the surface at night.

Genus **VALDIVIELLA** Steuer, 1904**Valdiviella minor** Wolfenden

[*Valdiviella minor* Wolfenden, Deut. Südpolar-Exped., 1901-1903, vol. 12, Zool., vol. 4, p. 249, pl. 29, figs. 8-11, 1911.]

Not found in the Atlantic plankton, and in the Pacific present in 1 nocturnal surface tow and 1 100-meter diurnal tow, and in the vertical tow from 1000 meters, station 64. There were 4 specimens in the surface tow and 1 in each of the other tows. This suggests a deep-water species which migrates to the surface at night but goes below the 100-meter level in the daytime.

Genus **VETTORIA** Wilson, 1924**Vettoria granulosa** (Giesbrecht)

[*Corina granulosa* Giesbrecht, Atti R. Accad. Lincei, Rome, ser. 4, vol. 7, sem. 1, p. 479, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, p. 645, pl. 49, figs. 39-45; pl. 50, figs. 53, 54, 1892.]

Not found in the Atlantic plankton, and in the Pacific confined chiefly to the southeastern and central regions. It was taken in 2 nocturnal surface tows, 3 diurnal 50-meter tows, and 12 diurnal 100-meter tows. It migrates at least occasionally to the surface at night, and by day stays in the two deeper tows, preferring the 100-meter level.

LITERATURE CITED

- BAIRD, WILLIAM. 1843. Note on the luminous appearance of the sea with descriptions of some of the entomostracous insects by which it is occasioned. *The Zoologist* (Newman), vol. 1, pp. 55-61.
- 1850. The natural history of the British Entomostraca. 8 pts., 364 pp., 36 pls. London.
- BOECK, AXEL. 1865. Oversigt over de ved Norges kyster iagttagne Copepoder henhørende til Calanidernes, Cyclopidernes og Harpacticidernes Familier. *Forhandl. Vidensk. Selsk. Christiania* for 1864, pp. 226-281.
- 1872. Nye Slaegter og Arter af Saltvands-Copepoder. *Forhandl. Vidensk. Selsk. Christiania*, vol. 14, pp. 35-60.
- BRADY, GEORGE S. 1883. Report on the Copepoda collected by H.M.S. Challenger during the years, 1873-76. *Challenger Exped., Zool.*, vol. 8, pt. 23. 142 pp., 55 pls.
- 1905. On copepods and other Crustacea taken off Northumberland and Durham in July, 1904. *Trans. Nat. Hist. Soc. Northumberland and Durham*, n. s., vol. 1, pp. 210-223, 4 pls.
- 1918. Copepoda. *In: Australasian Antarctic Exped., 1911-14*, ser. C, vol. 5, pt. 3. 48 pp., 15 pls.
- and R. D. ROBERTSON. 1873. Contributions to the study of the Entomostraca. 8, On marine Copepoda taken in the west of Ireland. *Ann. and Mag. Nat. Hist.*, ser. 4, vol. 12, 1873, pp. 126-142, pls. 8, 9.
- CANU, EUGÈNE. 1888. Les Copépods marins du Boulonnais. I: Les Calanidae. *Bull. sci. France et Belgique*, vol. 19, pp. 78-106, pls. 7-9.
- CLAUS, CARL. 1857. Das Genus *Cyclops* und seine einheimischen Arten. *Arch. f. Naturgesch.* (Berlin), vol. 23 (1), pp. 1-40, pls. 1-3.
- 1859. Ueber das Auge der Sapphirinen und Pontellen. *Arch. f. Anat., Physiol., wissensch. Med.*, Jahrg. 1859, pp. 269-274, pl. 5B.
- 1863. Die freilebenden Copepoden mit besonderer Berücksichtigung der Fauna Deutschlands, der Nordsee und des Mittelmeeres. 230 pp., 37 pls. Leipzig.
- 1866. Die Copepoden-Fauna von Nizza. Ein Beitrag zur Charakteristik der Formen und deren Abänderungen "im Sinne Darwin's." 34 pp., pls. 1-4. Marburg and Leipzig.
- CLEVE, P. T. 1900a. The plankton of the North Sea, the English Channel and the Skagerak in 1899. *Svenska Akad. Handl.*, vol. 134, no. 2. 77 pp.
- 1900b. The seasonal distribution of Atlantic plankton organisms. 368 pp. Göteborg.
- 1900-1901. Geographical distribution of Atlantic Copepoda and their physical condition. *Oefv. Vetensk. Akad. Förhandl.*, Stockholm, vol. 57, no. 2, pp. 139-144.
- 1904. The plankton of the South African seas. 1, Copepoda. *Marine Invest. South Africa*, vol. 3, pp. 177-210, 6 pls. Cape Town.
- DAHL, F. 1893. *Pleuromma*, ein Krebs mit Leuchtorgan. *Zool. Anz.*, vol. 16, no. 415, pp. 104-109.
- 1894a. Die Copepodenfauna des unteren Amazonas. *Ber. Naturforsch. Gesellsch. Freiburg*, n. s., vol. 8, pp. 10-23, pl. 1.
- 1894b. Ueber die horizontale und verticale Verbreitung der Copepoden im Ocean. *Verhandl. Deut. zool. Gesellsch.*, vol. 4, München, pp. 61-80, 4 text figs.
- DAHL, MARIA. 1912. Die Copepoden der Plankton-Expedition. I, Die Corycaeinem mit Berücksichtigung aller bekannten Arten bearb. *Ergebn. der Plankton-Exped. der Humboldt-Stiftung*, vol. 2, G. f. 1, 136 pp., 16 pls. Kiel and Leipzig.
- DAMAS, D., and E. KOEFOED. 1907. Le Plankton de la mer du Grönland. *In: Duc d'ORLÉANS, Croisière océanographique accomplie à bord de la Belgica dans la mer du Grönland en 1905*, pp. 347-453. Bruxelles.
- DANA, J. D. 1845. *Corycaeus*, novum genus Entomostracorum. *Proc. Acad. Nat. Sci. Phila.*, vol. 2, pp. 285-286.
- 1846. Notice of some genera of Cyclopoea. *Amer. Jour. Sci. and Arts*, ser. 2, vol. 1, no. 2, pp. 225-230.
- 1847. *Conspectus Crustaceorum quae in orbis terrarum circumnavigatione, Carolo Wilkes e classe Reipublicae Foederatae duce, lexit et descripsit Jacobus D. Dana. Pt. 1.* *Proc. Amer. Acad. Arts and Sci.*, vol. 1, pp. 150-154. (Reprinted in [Silliman's] *Amer. Jour. Sci. and Arts*, ser. 2, vol. 8, pp. 276-277, 1849.)
- 1849. *Conspectus Crustaceorum quae in orbis terrarum circumnavigatione, Carolo Wilkes e classe Reipublicae Foederatae duce, lexit et descripsit Jacobus D. Dana. Pt. 2.* *Proc. Amer. Acad. Arts and Sci.*, vol. 2, pp. 9-61. (Reprinted in [Silliman's] *Amer. Jour. Sci. and Arts*, ser. 2, vol. 8, pp. 278-285, 1849.)
- 1853-1855. United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes, U.S.N. Vol. 14, pt. 2, Crustacea, pp. 691-1618, 1853; folio atlas, 96 pls., 1855. Philadelphia.
- ESTERLY, C. O. 1905. Pelagic Copepoda of the San Diego region. *Univ. Calif. Publ., Zool.*, vol. 2, pp. 113-233, 62 text figs.
- 1906. Additions to the copepod fauna of the San Diego region. *Univ. Calif. Publ., Zool.*, vol. 3, pp. 53-92, pls. 9-14.
- 1911. Third report on the Copepoda of the San Diego region. *Univ. Calif. Publ., Zool.*, vol. 6, no. 14, pp. 313-352, pls. 26-32.
- 1912. The occurrence and vertical distribution of the Copepoda of the San Diego region, with particular reference to nineteen species. *Univ. Calif. Publ., Zool.*, vol. 9, no. 6, pp. 253-340, 7 text figs.
- FARRAN, G. P. 1905. Report on the Copepoda of the Atlantic slope off counties Mayo and Galway. *Ann. Rept. Fisheries, Ireland, 1902-03*, pt. 2, app. 2, pp. 23-52, pls. 3-13.
- 1908a. Note on the copepod genus *Oithona*. *Ann. and Mag. Nat. Hist.*, ser. 8, vol. 2, pp. 498-503.

- FARRAN, G. P. 1908b. Second report on the Copepoda of the Irish Atlantic slope. Fisheries, Ireland, Sci. Invest. for 1906, pt. 2. 104 pp., 11 pls.
- 1911. Plankton from Christmas Island, Indian Ocean. 1, On Copepoda of the family Corycaidae. Proc. Zool. Soc. London, 1911, pp. 282-296, pls. 10-14.
- 1913. Plankton from Christmas Island, Indian Ocean. 2, On Copepoda of the genera *Oithona* and *Paroithona*. Proc. Zool. Soc. London, 1913, pp. 181-193, pls. 27-31.
- 1929. British Antarctic (Terra Nova) Expedition. Crustacea, pt. 10, Copepoda. Nat. hist. rept. of Exped., Zool., vol. 8, no. 3, pp. 203-306, 4 pls., 37 text figs.
- GIESBRECHT, W. 1888-1891. Elenco dei Copepodi pelagici raccolti dal tenente di vascello Gaetano Chierchia durante il viaggio della R. Corvetta "Vettor Pisani" negli anni 1882-1885, e dal tenente di vascello Francesco Orsini nel Mar Rosso, nel 1884. Atti R. Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, pp. 284-287, 330-338, 1888; vol. 5, sem. 1, pp. 811-815; sem. 2, pp. 24-29, 1889; vol. 7, sem. 1, pp. 474-481, 1891.
- 1892. Systematik und Faunistik der pelagischen Copepoden des Golfes von Neapel und der angrenzenden Meeresabschnitte. Fauna und Flora des Golfes von Neapel, vol. 19. 831 pp., 54 pls. Berlin.
- 1895. Die pelagischen Copepoden. Bull. Mus. Comp. Zoöl., Harvard Coll., vol. 25, no. 12, pp. 243-263, pls. 1-4.
- 1896. Ueber pelagische Copepoden des Rothen Meeres, gesammelt vom Marinestabsarzt Dr. Augustin Krämer. Zool. Jahrb., Abth. Syst., vol. 9, pp. 315-328, pls. 5, 6.
- 1898. In: GIESBRECHT, W., and O. SCHMEIL, Copepoda. 1, Gymnoplea. Das Tierreich, Lief. 6, Crustacea 169 pp., 31 text figs.
- 1902. Copepoden. Rés. voyage S.Y. Belgica, 1897-99. Rapports scientifiques, Zool., 49 pp., 13 pls.
- 1903. Pp. 202, 203, pl. 7, fig. 8; pl. 8, fig. 29, in: LO BIANCO, SALVATORE, Le pesche abissali eseguite da F. A. Krupp col Yacht Puritan nelle adiacenze di Capri ed in altre località del Mediterraneo. Mittheil. aus der Zool. Stat. zu Neapel, vol. 16, pts. 1, 2, pp. 109-279, pls. 7-9.
- GUNNER, J. E. 1765. Nogle smaa rare, mestendelen nye norske Søedyr, beskrevne. Skr. Kjöbenhavnske Selsk., vol. 10, pp. 166-176, figs. 20-23.
- HAECKEL, ERNST. 1864. Beiträge zur Kenntnis der Corycaiden. Ztschr. f. Med. u. Naturwiss., Jena, vol. 1, pp. 61-112, pls. 1-3.
- HELLER, CAMIL. 1865. Reise der österreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858, 1859. Zool. Theil, vol. 2, Abth. 3, pt. I, Crustacea. 280 pp., 25 pls. Wien.
- JESPERSEN, P. 1926. On the quantity of macroplankton in the Mediterranean and the Atlantic. Internat. Rev. Hydrobiol. u. Hydrogr., vol. 12, pp. 104-115, pls. 9-13.
- KOEFOED, E., and D. DAMAS. See DAMAS, D., and E. KOEFOED.
- KRÄMER, AUGUSTIN. 1896. Zwei neue *Pontella*-Arten aus Neu-Süd-Wales. Zool. Jahrb., Abth. Syst., vol. 9, pp. 720-724, text figs. 1-11.
- KRØYER, HENRIK. 1838. Grönlands Amphipoder. II: Beskrivelse af nogle Grönlandske Kraebdyr udenfor Amphipodernen. III: Oversigt af de Grönlandske Kraebdyr, ledsaget af nogle zoologisk-geografiske Bemærkninger. Kong. Danske Vidensk. Selsk., Naturvidensk. og. math. Afh., vol. 7, pp. 301-326, pl. 4.
- 1842-1845. Crustacés. Atlas, pls. 41-43, in: GAIMARD, PAUL, Voyages de la Commission scientifique du Nord en Scandinavie, en Laponie, au Spitzberg et aux Feröe pendant les années 1838, 1839 et 1840 sur la corvette "La Recherche." Paris.
- 1848-1849. Karcinologiske Bidrag. Naturhist. Tidsskr., Kjöbenhavn, ser. 2, vol. 2, pp. 527-609, pl. 6 (pp. 527-560, 1848; pp. 561-609, 1849).
- LEACH, W. E. 1816. Annulosa. Encyclopaedia Britannica, suppl. to 4th, 5th, and 6th eds., vol. 1, 1824 (actually published in 1816), pp. 401-453, pls. 20-26.
- 1819. Entomostracés. Dictionnaire des sciences naturelles, vol. 14, pp. 524-545.
- LÉGER, L. 1892. Tablettes zoologiques, vol. 3, p. 144. Publié sous la direction de Aimé Schneider, Poitiers.
- LILLJEBORG, WILLIAM. 1853. De Crustaceis ex ordinis tribus, in Scaniâ occurrentibus—Cladocera, Ostracoda, et Copepoda. [Original title: Om de inom Skaane foerekommande Crustaceer af ovdringarne Cladocera, Ostracoda och Copepoda.] 222 pp., 27 pls. Lund, Akademisk Afhandling.
- LÖNNBERG, EINAR. 1889. Bidrag till Kännedomen om fritt lefrande Caligider. Biol. Fören. Förhandl. (Verhandl. Biol. Vereins), Stockholm, vol. 1, nos. 7-8, pp. 148-158, 3 text figs.
- LUBBOCK, JOHN. 1853. Description of a new genus of Calanidae. Ann. and Mag. Nat. Hist., ser. 2, vol. 11, pp. 25-29, pl. 1.
- 1854. On some arctic species of Calanidae. Ann. and Mag. Nat. Hist., ser. 2, vol. 14, pp. 125-129, pl. 5.
- 1856. On some Entomostraca collected by Dr. Sutherland in the Atlantic Ocean. Trans. Entomol. Soc. London, n. s., vol. 4, pt. 1, pp. 8-39, pls. 2-12.
- 1857. Description of eight new species of Entomostraca. Ann. and Mag. Nat. Hist., ser. 2, vol. 20, pp. 401-410, pls. 10, 11, figs. 7, 8.
- 1863. On some oceanic Entomostraca collected by Captain Toynbee. Trans. Linn. Soc. London, vol. 23, pp. 173-190, pl. 29.
- MICHAEL, E. L. 1913. Vertical distribution of the chaetognaths of the San Diego region. Amer. Naturalist, vol. 47, pp. 17-49.
- MILNE EDWARDS, HENRI. 1840. Histoire naturelle des Crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux, vol. 3. 638 + 32 pp., 42 pls.
- MÜLLER, O. FR. 1785. Entomostraca, seu insecta testacea quae in aquis Daniae et Norvegiae reperit, descripsit, et iconibus illustravit. iv + 134 pp., 21 col. pls. Leipzig.

- NORMAN, A. M. 1903. New generic names for some Entomostraca and Cirripedia. *Ann. and Mag. Nat. Hist.*, ser. 7, vol. 11, pp. 367-369.
- OKEN, L. 1815-1816. *Lehrbuch der Naturgeschichte*. Pt. 3, Zoologie. 2 vols., with atlas. Jena.
- PARKER, G. H. 1902. The reactions of copepods to various stimuli and the bearing of this on daily depth migrations. *U. S. Fish. Commission Bull.* for 1901, pp. 103-123.
- PEARSON, JOSEPH. 1906. A list of the marine Copepoda of Ireland. Pt. 2, Pelagic species. *Rept. Fisheries, Ireland, Sci. Invest.* for 1905, no. 6. 37 pp.
- PHILIPPI, A. 1843. Fernere Beobachtungen über die Copepoden des Mittelmeeres. Über *Cyclopsina*. *Arch. f. Naturgesch.* (Wiegmann), Jahrg. 9, pp. 54-71, 1 table, pls. 3, 4.
- PRESTANDREA, NICOLO. 1833. Su di alcuni nuovi crostacei del mare di Messina. *Effemeridi sci. e lett. Sicilia*, vol. 6, pp. 3-14.
- RICHARD, JULES. 1892. Sur l'identité des genres *Ilyopsyllus* Brady & Rob. et *Abacola* Edwards: description de *Ilyopsyllus jousseaumei*, n. sp. *Bull. Soc. zool. France*, vol. 17, pp. 69-74.
- ROSE, M. 1925. Contribution à l'étude de la biologie du plankton. Le problème des migrations verticales journalières. *Arch. zool. expér. et gén.*, vol. 64, pp. 387-542, 41 text figs.
- 1929. Copépodes pélagiques particulièrement de surface provenant des campagnes scientifiques de S.A.S. Prince Albert 1^{er} de Monaco. *Rés. camp. sci. Albert de Monaco*, no. 78. 123 pp., 6 pls.
- RUSSELL, F. S. 1925. The vertical distribution of marine macroplankton. An observation on diurnal changes. *Jour. Marine Biol. Assoc.*, n. s., vol. 13, no. 4, pp. 769-809, pl. 1, text figs. 1-6.
- 1926a. The vertical distribution of marine macroplankton. 2, The pelagic young of teleostean fishes in the daytime in the Plymouth area, with a note on the eggs of certain species. *Jour. Marine Biol. Assoc.*, n. s., vol. 14, no. 1, pp. 101-159, figs. 1-5.
- 1926b. The vertical distribution of marine macroplankton. 3, Diurnal observations of the pelagic young of teleostean fishes in the Plymouth area. *Jour. Marine Biol. Assoc.*, n. s., vol. 14, no. 2, pp. 387-414, figs. 1-8.
- 1926c. The vertical distribution of marine macroplankton. 4, The apparent importance of light intensity as a controlling factor in the behavior of certain species in the Plymouth area. *Jour. Marine Biol. Assoc.*, n. s., vol. 14, no. 2, pp. 415-440, figs. 1-7.
- 1927a. The vertical distribution of marine macroplankton. 5, The distribution of animals caught in the ring-trawl in the daytime in the Plymouth area. *Jour. Marine Biol. Assoc.*, n. s., vol. 14, no. 3, pp. 557-608, figs. 1-11.
- 1927b. The vertical distribution of plankton in the sea. *Biol. Rev.*, vol. 2, no. 3, pp. 213-262, 8 text figs.
- 1928. The vertical distribution of marine macroplankton. Seven observations on the behavior of *Calanus finmarchicus*. *Jour. Marine Biol. Assoc.*, n. s., vol. 15, no. 2, pp. 429-454, figs. 1-6.
- SARS, G. O. 1884. p. 131, in: J. SPAARE SCHNEIDER, *Rept. Invertebrata from the Kvaenangen Fjord*. Tromsø Mus. Aarsh., no. 7, pp. 47-134, pls. 1-5.
- 1900. Crustacea. The Norwegian North Polar Expedition, 1893-1896. *Sci. res.*, vol. 5. 141 pp., 36 pls.
- 1901-1903. An account of the Crustacea of Norway. Vol. 4, Copepoda Calanoida. Pts. 1, 2, pp. 1-28, pls. 1-16, 1901. Pts. 3-12, pp. 29-144, pls. 17-96, 1902. Pts. 13, 14, pp. 145-171, pls. 97-102 and suppl., 1903; pls. 1-6, 1903. Bergen.
- 1903-1911. An account of the Crustacea of Norway. Vol. 5, Copepoda Harpacticoida. Pts. 1, 2, pp. 1-28, pls. 1-16, 1903. Pts. 3-6, pp. 29-72, pls. 17-48, 1904. Pts. 7-10, pp. 73-132, pls. 49-80, 1905. Pts. 11-16, pp. 133-196, pls. 81-128, 1906. Pts. 17-20, pp. 197-240, pls. 129-160, 1907. Pts. 21-24, pp. 241-276, pls. 161-192, 1908. Pts. 25-28, pp. 277-336, pls. 193-224, 1909. Pts. 29, 30, pp. 337-368, pls. 225-230 and suppl., 1910; pls. 1-10 and suppl., 1910. Pts. 31-36, pp. 369-443, pls. 11-54, 1911. Bergen.
- 1905a. Liste préliminaire des Calinoidés recueillis pendant les campagnes de S.A.S. le Prince Albert de Monaco, avec diagnoses des genres et des espèces nouvelles. Pt. 1. *Bull. Mus. océanogr. Monaco*, no. 26. 22 pp.
- 1905b. Liste préliminaire des Calinoidés recueillis pendant les campagnes de S.A.S. le Prince Albert de Monaco, avec diagnoses des genres et des espèces nouvelles. Pt. 2. *Bull. Mus. océanogr. Monaco*, no. 40. 24 pp.
- 1905c. 2. Brackwasser-Crustaceen von den Chatham-Inseln. *Zool. Jahrb., Abth. Syst.*, vol. 21, pp. 371-414, 7 pls.
- 1907. Notes supplémentaires sur les Calinoidés de la Princesse-Alice. *Bull. Inst. océanogr. Monaco*, no. 101. 27 pp.
- 1913-1918. An account of the Crustacea of Norway. Vol. 6, Copepoda Cyclopoida. Pts. 1-4, pp. 1-56, pls. 1-32, 1913. Pts. 5, 6, pp. 57-80, pls. 33-48, 1914. Pts. 7-10, pp. 81-140, pls. 49-80, 1915. Pts. 11, 12, pp. 141-172, pls. 81-96, 1917. Pts. 13, 14, pp. 173-225, pls. 97-118, 1918. Bergen.
- 1916. Liste systématique des Cyclopoidés, Harpacticoidés et Monstrilloidés recueillis pendant les campagnes de S.A.S. le Prince Albert de Monaco, avec descriptions et figures des espèces nouvelles. *Bull. Inst. océanogr. Monaco*, no. 323. 15 pp., 8 pls.
- 1919-1921. An account of the Crustacea of Norway. Vol. 7, Copepoda, supplement. Pts. 1, 2, pp. 1-24, pls. 1-16, 1919. Pts. 3-8, pp. 25-92, pls. 17-64, 1920. Pts. 9, 10, pp. 93-121, pls. 65-76, 1921.
- 1920. Calanoidés recueillis pendant les campagnes de S.A.S. le Prince Albert de Monaco. (Nouveau supplément.) *Bull. Inst. océanogr. Monaco*, no. 377. 20 pp.

- SARS, G. O. 1921. An account of the Crustacea of Norway. Vol. 8, Copepoda Monstrilloida and Notodelphyoida. Pts. 1-6, pp. 1-91, pls. 1-37. Bergen.
- 1924-1925. Copépodes particulièrement bathypélagiques provenant des campagnes scientifiques du Prince Albert 1^{er} de Monaco. Rés. camp. sci. Albert de Monaco, no. 69. 128 pls., 1924; text, 408 pp., 1925.
- SAY, THOMAS. 1818. An account of the Crustacea of the United States. Jour. Acad. Nat. Sci. Phila., vol. 1, pp. 423-458.
- SCHMITT, WALDO L. 1941. Charles Branch Wilson [obituary notice]. Science, vol. 94, no. 2442, pp. 358-359.
- SCOTT, ANDREW. 1909. The Copepoda of the Siboga Expedition in the Dutch East Indies 1899-1900. Vol. 29a, pt. 1, Free-swimming, littoral and semi-parasitic Copepoda. 323 pp., 69 pls. Leyden.
- SCOTT, THOMAS. 1894. Report on Entomostraca from the Gulf of Guinea. Trans. Linn. Soc. London, ser. 2, Zool., vol. 6, pt. 1. 161 pp., 15 pls.
- SEWELL, R. B. SEYMOUR. 1924. Fauna of the Chilka Lake, Crustacea Copepoda. Mem. Indian Mus., Calcutta, vol. 5, pp. 771-851, 16 pls.
- SHARPE, R. W. 1910. Notes on the marine Copepoda and Cladocera of Woods Hole and adjacent regions, including a synopsis of the genera of the Harpacticoida. Proc. U. S. Nat. Mus., vol. 38, pp. 405-436.
- STEBBING, T. R. R. 1910. General catalogue of South African Crustacea. Ann. South African Mus., vol. 6, pp. 281-593, pls. 15-22.
- STEENSTRUP, J. J. S., and C. F. LÜTKEN. 1861. Bidrag til Kundskab om det aabne Havs Snyltekrebs og Lernaer samt om nogle andre nye eller hidtil kun ufuldstændigt kjendte parasitiska Copepoder. Kong. Danske Vidensk. Selsk. Skr., ser. 5, Naturhist. og math. Afd., vol. 5, pp. 343-432, pls. 1-15.
- STEUER, ADOLF. 1904. 3. Copepoden der Valdivia Expedition. Zool. Anz., vol. 27, no. 19, pp. 593-598, 4 text figs.
- 1932. Copepoda 6: *Pleuromamma* Giesbr., 1898, der Deutschen Tiefsee-Expedition. Wissensch. Ergebn. d. Deut. Tiefsee-Exped., vol. 24, no. 1. 118 pp., 17 pls., 196 text figs.
- 1933. Bericht über die Bearbeitung der Copepodengattung *Pleuromamma* Giesbrecht, 1898, der Deutschen Tiefsee-Expedition "Valdivia." Thalassia, vol. 1, no. 2, pp. 1-48, 141 text figs., 17 maps.
- TEMPLETON, ROBERT. 1837. Description of a new Irish crustacean animal (*Anomalocera patersonii*). Trans. Entomol. Soc. London, vol. 2, pt. 1, pp. 34-40, pl. 5.
- THOMPSON, I. C. 1888. Copepoda of Madeira and the Canary Islands, with descriptions of new genera and species. Jour. Linn. Soc. London, Zool., vol. 20, 1887, pp. 145-156, pls. 10-13.
- and ANDREW SCOTT. 1903. Report on Copepoda collected by Professor Herdman at Ceylon in 1902. Ceylon Pearl Oyster Fisheries, Suppl. rept., no. 7; Rept. to Colonial Government, pt. 1, pp. 227-307, pls. 1-20.
- THOMPSON, JOHN V. 1830. On the luminosity of the ocean, with descriptions of some remarkable species of luminous animals (*Pyrosoma pigmaca* and *Sapphirina indicator*), and particularly of the four new genera, *Nocticula* [sic], *Cynthia*, *Lucifer*, and *Podopsis* of the Shizopoda [sic]. (Addenda to Memoir 1. Addendum to Memoir 2.) Zoological researches, and illustrations; or natural history of nondescript or imperfectly known animals, in a series of memoirs, vol. 1, mem. 3. Vol. 1, 110 pp., 14 pls.
- VAN BREEMEN, P. J. 1907. Copepoden des nordischen Planktons. Nordisches Plankton Kiel 7, Lief. 8. 264 pp., 251 figures.
- WIERZEJSKI, A. 1877. Ueber Schmarotzerkrebse von Cephalopoden. Ztschr. f. wissensch. Zool., vol. 29, pp. 562-582, pls. 32-34.
- WILSON, C. B. 1907. North American parasitic copepods belonging to the family Caligidae. Pt. 2, The Trebiniae and Euryphorinae. Proc. U. S. Nat. Mus., vol. 31, pp. 669-720, pls. 15-20.
- 1923. Parasitic copepods in the collection of the Riksmuseum at Stockholm. Arch. f. Zoologi, vol. 15, no. 3. 15 pp., 2 pls.
- 1924. New North American parasitic copepods, new hosts, and notes on copepod nomenclature. Proc. U. S. Nat. Mus., vol. 64, art. 17. 22 pp., 3 pls.
- 1932a. The copepod crustaceans of Chesapeake Bay. Proc. U. S. Nat. Mus., vol. 80, art. 15, pp. 1-54, pls. 1-5.
- 1932b. The copepods of the Woods Hole region, Massachusetts. U. S. Nat. Mus. Bull. 158. 635 pp., 41 pls., 316 figs.
- WITH, CARL. 1915. Copepoda. 1, Calanoida Amphiscandria. Danish Ingolf-Exped., vol. 3, no. 4. 260 pp., 8 pls., 422 text figs., 1 chart.
- WOLFENDEN, R. N. 1904. Notes on the Copepoda of the North Atlantic Sea and the Farøe Channel. Jour. Marine Biol. Assoc., n. s., vol. 7, no. 1, pp. 110-146, pl. 9.
- 1911. Die marinen Copepoden der deutschen Südpolar-Expedition, 1901-03. 2, Die pelagischen Copepoden der Westwinddrift und des südlichen Eismers mit Beschreibung mehrerer neuer Arten aus dem atlantischen Ozean. Deut. Südpolar-Exped., vol. 12, Zool., vol. 4, pp. 181-401, pls. 22-44, text figs. 1-82.

LIST OF SPECIES DISCUSSED

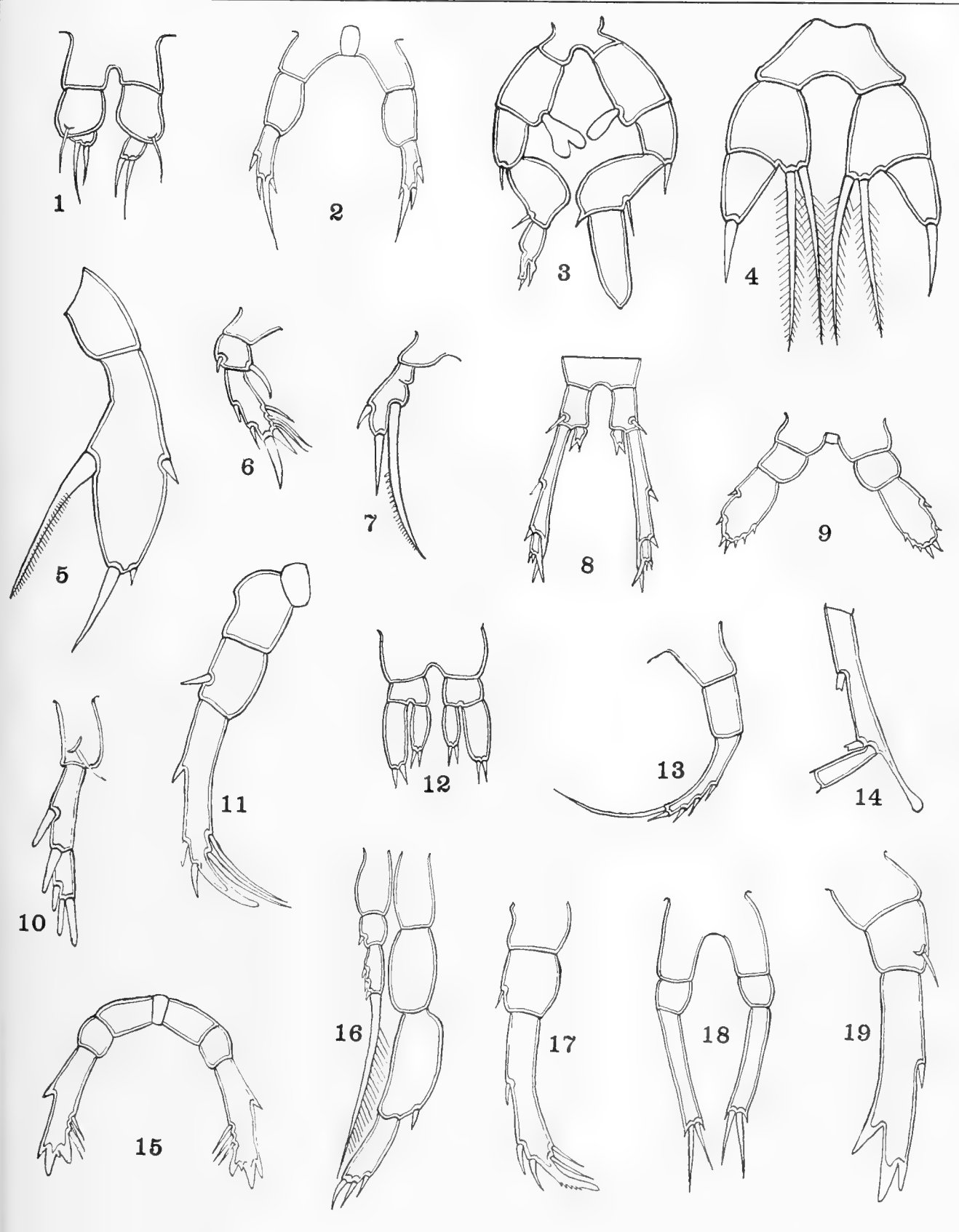
Species	Atlantic	Pacific	Species	Atlantic	Pacific
<i>Acartia clausii</i>	x	x	<i>Clausocalanus arcuicornis</i>	x	x
<i>danae</i>.....	..	x	<i>furcatus</i>.....	..	x
<i>longiremis</i>	x	x	<i>Clytemnestra rostrata</i>	x	x
<i>negligens</i>.....	..	x	<i>scutellata</i>	x	x
<i>Acrocalanus gibber</i>.....	..	x	<i>Conaea gracilis</i>.....	..	x
<i>gracilis</i>.....	..	x	<i>Copilia denticulata</i>	x	x
<i>longicornis</i>.....	..	x	<i>mirabilis</i>.....	..	x
<i>monachus</i>.....	..	x	<i>quadrata</i>.....	..	x
<i>Aegisthus spinulosus</i>.....	..	x	<i>recta</i>.....	..	x
<i>Aetideus armatus</i>	x	x	<i>vitrea</i>.....	..	x
<i>Amallophora typica</i>.....	..	x	<i>Corycaeus agilis</i>	x	x
<i>Amalothrix arcuata</i>.....	..	x	<i>andrewsi</i>.....	..	x
<i>obtusifrons</i>.....	..	x	<i>anglicus</i>	x	x
<i>propinqua</i>.....	..	x	<i>catus</i>.....	..	x
<i>valida</i>.....	..	x	<i>clausi</i>	x	x
<i>Anomalocera patersonii</i>	x	x	<i>crassiusculus</i>	x	x
<i>Arietellus setosus</i>.....	..	x	<i>dubius</i>	x	x
<i>Augaptilus longicaudatus</i>.....	..	x	<i>flaccus</i>	x	x
<i>Bathycalanus rigidus</i>.....	..	x	<i>furcifer</i>	x	x
<i>Calanopia americana</i>	x	..	<i>giesbrechti</i>.....	..	x
<i>elliptica</i>	x	x	<i>lautus</i>	x	x
<i>Calanus cristatus</i>.....	..	x	<i>limbatus</i>	x	x
<i>finmarchicus</i>	x	x	<i>longistylis</i>.....	..	x
<i>helgolandicus</i>	x	x	<i>lubbockii</i>.....	..	x
<i>hyperboreus</i>.....	..	x	<i>minimus</i>	x	x
<i>minor</i>	x	x	<i>ovalis</i>	x	x
<i>propinquus</i>	x	x	<i>pacificus</i>.....	..	x
<i>tonsus</i>.....	..	x	<i>pumilus</i>	x	x
<i>Calocalanus pavo</i>	x	x	<i>robustus</i>.....	..	x
<i>plumulosus</i>.....	..	x	<i>speciosus</i>	x	x
<i>styliremis</i>	x	x	<i>typicus</i>	x	x
<i>Candacia aethiopica</i>	x	x	<i>Danodes plumata</i> , n. gen. and n. sp.....	..	x
<i>armata</i>.....	..	x	<i>Drepanopus pectinatus</i>	x	..
<i>bipinnata</i>.....	..	x	<i>Dysgamus atlanticus</i>.....	..	x
<i>bispinosa</i>	x	x	<i>Euaetideus bradyi</i>.....	..	x
<i>catula</i>.....	..	x	<i>giesbrechti</i>.....	..	x
<i>curta</i>.....	..	x	<i>Euaugaptilus filigerus</i>.....	..	x
<i>falcifera</i>	x	..	<i>Eucalanus attenuatus</i>	x	x
<i>longimana</i>.....	..	x	<i>crassus</i>.....	..	x
<i>norvegica</i>	x	x	<i>elongatus</i>	x	x
<i>pachydactyla</i>	x	x	<i>monachus</i>.....	..	x
<i>simplex</i>	x	x	<i>mucronatus</i>.....	..	x
<i>tenuimana</i>.....	..	x	<i>subtenuis</i>.....	..	x
<i>truncata</i>.....	..	x	<i>Euchaeta acuta</i>.....	..	x
<i>varicans</i>	x	x	<i>hebes</i>.....	..	x
<i>Canthocalanus pauper</i>.....	..	x	<i>marina</i>	x	x
<i>Carnegiella gracilis</i> , n. gen. and n. sp.....	..	x	<i>spinosa</i>.....	..	x
<i>Centraugaptilus rattrayi</i>	x	..	<i>Euchaetopsis?</i> sp.....	x	..
<i>Centropages calaninus</i>.....	..	x	<i>Euchirella brevis</i>	x	x
<i>chierchiae</i>	x	..	<i>curticauda</i>	x	x
<i>elongatus</i>.....	..	x	<i>intermedia</i>.....	..	x
<i>furcatus</i>	x	x	<i>messinensis</i>.....	..	x
<i>hamatus</i>	x	x	<i>pulchra</i>	x	x
<i>typicus</i>	x	..	<i>rostrata</i>	x	x
<i>violaceus</i>	x	x	<i>Euterpina acutifrons</i>.....	..	x
<i>Chiridiella</i> sp.....	..	x	<i>Farranula carinata</i>	x	x
<i>Chiridius poppei</i>.....	..	x	<i>concinna</i>.....	..	x

Species	Atlantic	Pacific	Species	Atlantic	Pacific
<i>Farranula curta</i>	x	x	<i>Neocalanus robustior</i>	..	x
<i>gibbula</i>	x	x	<i>tenuicornis</i>	x	x
<i>gracilis</i>	x	x	<i>Nesippus</i> sp.	..	x
<i>rostrata</i>	x	x	<i>Oithona attenuata</i>	..	x
<i>Gaetanus armiger</i>	..	x	<i>brevicornis</i>	..	x
<i>kruppii</i>	..	x	<i>fallax</i>	..	x
<i>latifrons</i>	..	x	<i>hebes</i>	x	..
<i>miles</i>	..	x	<i>linearis</i>	..	x
<i>minor</i>	..	x	<i>plumifera</i>	x	x
<i>Gaidius affinis</i>	..	x	<i>robusta</i>	..	x
<i>brevispinus</i>	x	..	<i>setiger</i>	x	x
<i>tenuispinus</i>	..	x	<i>similis</i>	x	x
<i>Haloptilus acutifrons</i>	..	x	<i>spinostris</i>	x	x
<i>angusticeps</i>	..	x	<i>vivida</i>	..	x
<i>longicornis</i>	x	x	<i>Oithonina nana</i>	x	x
<i>ornatus</i>	x	x	<i>Oncaea anglica</i>	..	x
<i>oxycephalus</i>	..	x	<i>conifera</i>	x	x
<i>plumosus</i>	x	x	<i>curta</i>	x	x
<i>spiniceps</i>	x	x	<i>curvata</i>	..	x
<i>Heteramella dubia</i>	..	x	<i>dentipes</i>	..	x
<i>Heterorhabdus abyssalis</i>	..	x	<i>media</i>	x	x
<i>compactus</i>	..	x	<i>mediterranea</i>	..	x
<i>norvegicus</i>	x	..	<i>minuta</i>	x	x
<i>papilliger</i>	x	x	<i>notopa</i>	x	x
<i>spinifrons</i>	..	x	<i>ornata</i>	..	x
<i>Heterostylites longicornis</i>	..	x	<i>similis</i>	x	x
<i>Labidocera acuta</i>	..	x	<i>subtilis</i>	x	x
<i>acutifrons</i>	..	x	<i>tenella</i>	x	x
<i>detruncata</i>	..	x	<i>venusta</i>	x	x
<i>nerii</i>	x	x	<i>Onchocalanus cristatus</i>	..	x
<i>wollastoni</i>	x	..	<i>nudipes</i> , n. sp.	..	x
<i>Lophothrix frontalis</i>	..	x	<i>trigoniceps</i>	..	x
<i>humilifrons</i>	..	x	<i>Pachos punctatum</i>	x	x
<i>Lubbockia aculeata</i>	x	x	<i>tuberosum</i>	..	x
<i>squillimana</i>	x	x	<i>Pachyptilus abbreviatus</i>	..	x
<i>Lucicutia bicornuta</i>	..	x	<i>Pandarus satyrus</i>	..	x
<i>clausii</i>	x	x	<i>sinuatus</i>	..	x
<i>curta</i>	..	x	<i>Paracalanus aculeatus</i>	..	x
<i>flavicornis</i>	x	x	<i>parvus</i>	x	x
<i>grandis</i>	x	..	<i>pygmaeus</i>	..	x
<i>longicornis</i>	x	x	<i>Pareuchaeta grandiremis</i>	x	..
<i>Macrosetella gracilis</i>	x	x	<i>incisa</i>	..	x
<i>oculata</i>	x	x	<i>tonsa</i>	x	x
<i>Mecynocera clausi</i>	x	x	<i>tumidula</i>	..	x
<i>Megacalanus longicornis</i>	x	x	<i>Pennella</i> sp.	..	x
<i>princeps</i>	x	x	<i>Phacna spinifera</i>	x	x
<i>Mesocyclops leuckarti</i>	..	x	<i>Phyllopus helgae</i>	..	x
<i>Metis jousseaumei</i>	..	x	<i>Pleuromamma abdominalis</i>	..	x
<i>Metridia brevicauda</i>	..	x	<i>gracilis</i>	x	x
<i>curticauda</i>	x	..	<i>quadrangulata</i>	..	x
<i>longa</i>	x	x	<i>robusta</i>	..	x
<i>lucens</i>	x	x	<i>xiphias</i>	x	x
<i>princeps</i>	..	x	<i>Pontella atlantica</i>	x	x
<i>Microcalanus pusillus</i>	x	x	<i>cristata</i>	..	x
<i>pygmaeus</i>	x	x	<i>danae</i>	..	x
<i>Microsetella norvegica</i>	x	x	<i>lobiancoi</i>	x	x
<i>rosea</i>	x	x	<i>pennata</i>	x	..
<i>Miracia efferata</i>	x	x	<i>princeps</i>	..	x
<i>Monstrilla inserta</i>	..	x	<i>securifer</i>	x	x
<i>Neocalanus gracilis</i>	x	x	<i>tenuiremis</i>	..	x

Species	Atlantic	Pacific	Species	Atlantic	Pacific
<i>Pontellina plumata</i>	x	x	<i>Scolecithricella abyssalis</i>.....	..	x
<i>Pontellopsis armata</i>.....	..	x	<i>auropecten</i>.....	..	x
<i>lubbockii</i>.....	..	x	<i>bradyi</i>.....	..	x
<i>perspicax</i>	x	..	<i>marginata</i>.....	..	x
<i>regalis</i>	x	x	<i>minor</i>	x	x
<i>villosa</i>.....	..	x	<i>ovata</i>	x	..
<i>Pseudocalanus gracilis</i>.....	..	x	<i>porrecta</i>.....	..	x
<i>minutus</i>	x	x	<i>spinacantha</i> , n. sp.....	..	x
<i>Pseudochirella divaricata</i>.....	..	x	<i>Scolecithrix danae</i>	x	x
<i>Rhincalanus cornutus</i>	x	x	<i>Spinocalanus abyssalis</i>	x	x
<i>nasutus</i>	x	x	<i>caudatus</i>.....	..	x
<i>Sapphirina angusta</i>	x	x	<i>magnus</i>.....	..	x
<i>auronitens</i>	x	x	<i>Temora discaudata</i>.....	..	x
<i>darwinii</i>	x	..	<i>longicornis</i>	x	x
<i>metallina</i>.....	..	x	<i>styliifera</i>	x	x
<i>nigromaculata</i>	x	x	<i>Temoropia mayumbaensis</i>.....	..	x
<i>opalina</i>.....	..	x	<i>Undeuchaeta major</i>.....	..	x
<i>ovatlanceolata</i>.....	..	x	<i>plumosa</i>.....	..	x
<i>pyrosomatis</i>.....	..	x	<i>Undinopsis bradyi</i>.....	..	x
<i>salpae</i>.....	..	x	<i>Undinula caroli</i>.....	..	x
<i>scarlata</i>	x	x	<i>darwinii</i>.....	..	x
<i>stellata</i>	x	x	<i>vulgaris</i>	x	x
<i>Scaphocalanus elongatus</i>.....	..	x	<i>Valdiviella minor</i>.....	..	x
<i>magnus</i>.....	..	x	<i>Vettoria granulosa</i>.....	..	x
<i>medius</i>.....	..	x			

FIGURES 1-19

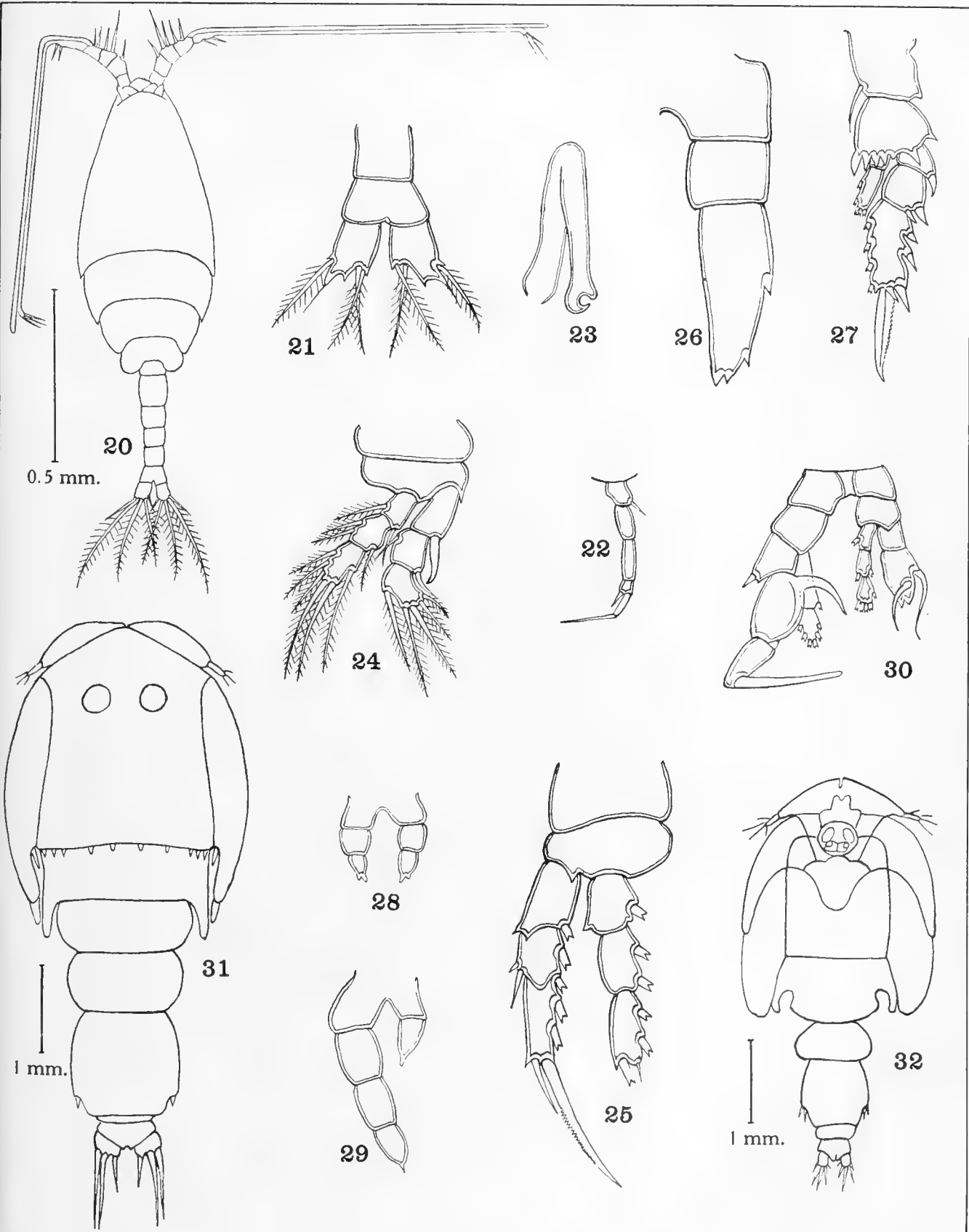
- FIG. 1. *Amalophora typica*, fifth legs of female.
FIG. 2. *Calanopia americana*, fifth legs of female.
FIG. 3. *Arietellus setosus*, fifth legs of male.
FIG. 4. *Arietellus setosus*, fifth legs of female.
FIG. 5. *Amallothrix arcuata*, fifth leg of adult female.
FIG. 6. *Candacia norvegica*, fifth leg of female.
FIG. 7. *Amallothrix valida*, fifth leg of adult female.
FIG. 8. *Anomalocera patersonii*, fifth legs of female.
FIG. 9. *Candacia bispinosa*, fifth legs of young female.
FIG. 10. *Calanopia elliptica*, fifth leg of female.
FIG. 11. *Candacia truncata*, fifth leg of female.
FIG. 12. *Calocalanus styliremis*, fifth legs of young male.
FIG. 13. *Candacia falcifera*, fifth leg of female.
FIG. 14. *Calocalanus styliremis*, penultimate and antepenultimate segments of first antenna.
FIG. 15. *Candacia pachydactyla*, fifth legs of female.
FIG. 16. *Candacia simplex*, fifth legs of male.
FIG. 17. *Candacia simplex*, fifth leg of female.
FIG. 18. *Calocalanus plumulosus*, fifth legs of female.
FIG. 19. *Candacia curta*, fifth leg of female.



FIGURUS 1-19

FIGURES 20-32

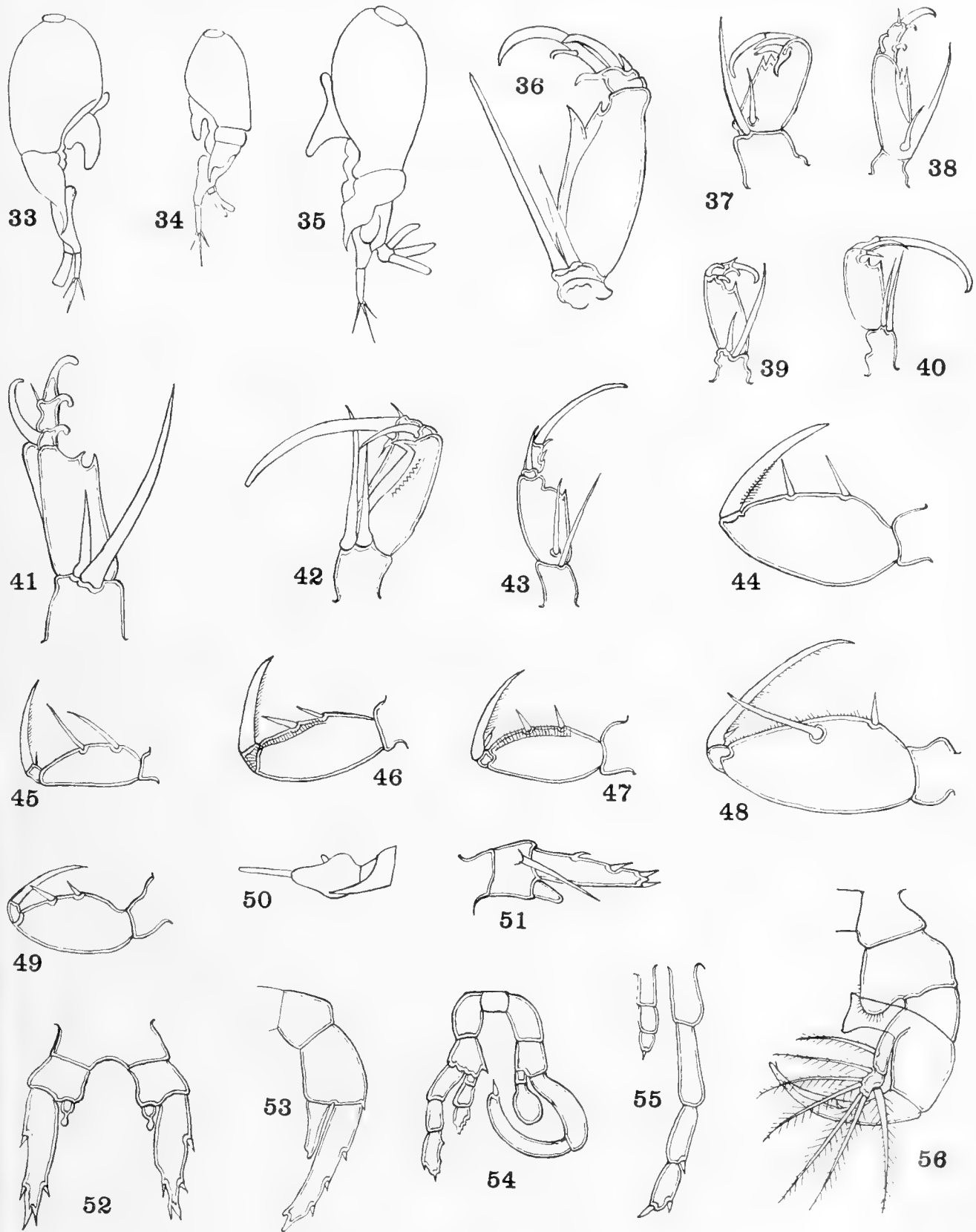
- FIGS. 20-25. *Carnegiella gracilis*, n. gen. and n. sp., female. Fig. 20, dorsal view; fig. 21, two posterior abdominal segments and caudal rami, dorsal view; fig. 22, second antenna; fig. 23, maxilliped; fig. 24, first leg; fig. 25, fourth leg.
- FIG. 26. *Candacia longimana*, fifth leg of female.
- FIG. 27. *Clausocalanus furcatus*, second leg of female.
- FIG. 28. *Clausocalanus furcatus*, fifth legs of female.
- FIG. 29. *Clausocalanus furcatus*, fifth legs of male.
- FIG. 30. *Centropages calaninus*, fifth legs of male.
- FIG. 31. *Nesippus* sp., male, dorsal view.
- FIG. 32. *Dysgamus atlanticus*, male, dorsal view.



FIGURES 20-32

FIGURES 33-56

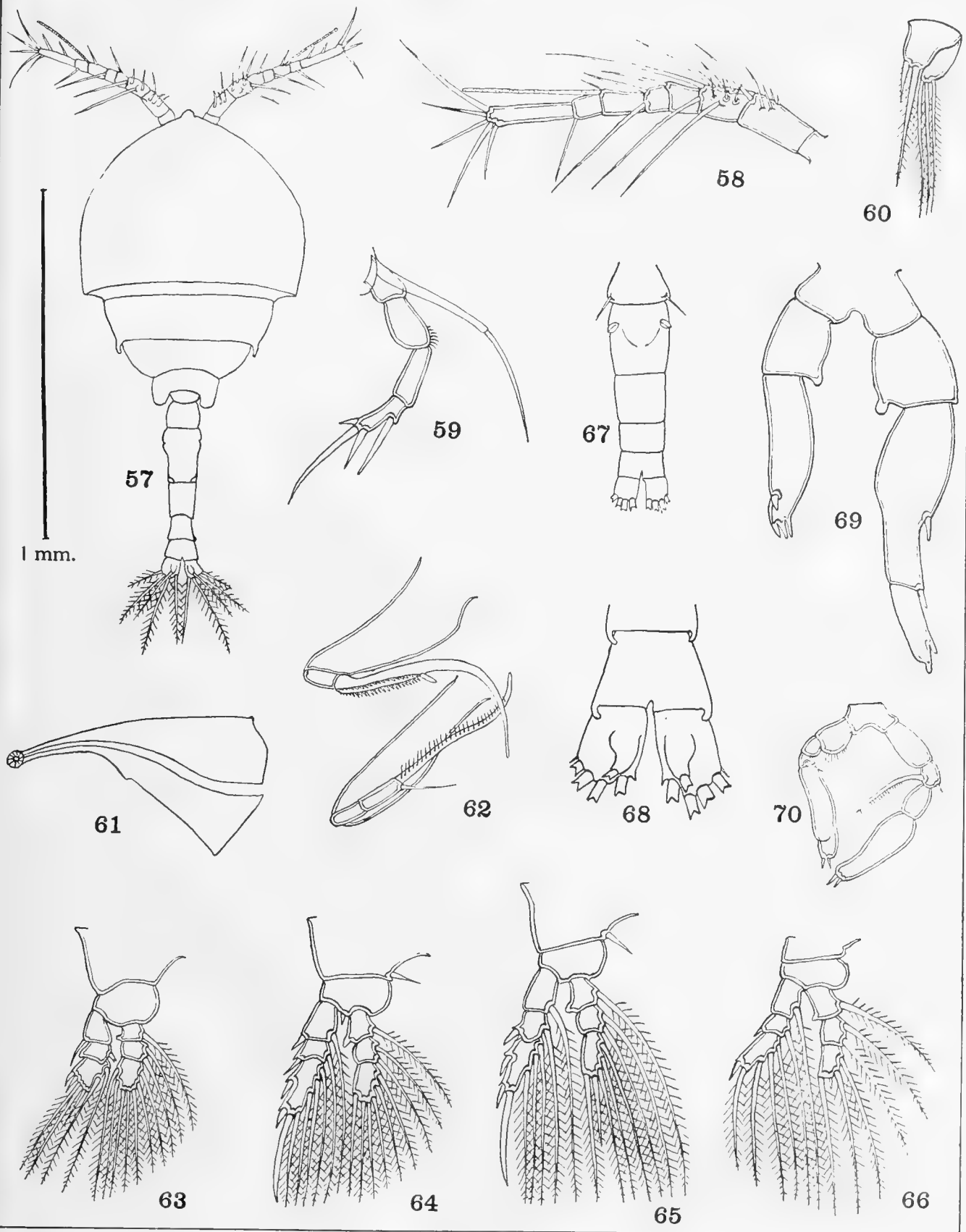
- FIG. 33. *Farranula concinna*, female, lateral view.
 FIG. 34. *Farranula gracilis*, female, lateral view.
 FIG. 35. *Farranula gibbula*, female, lateral view.
 FIG. 36. *Corycaeus andrewsi*, second antenna of female.
 FIG. 37. *Corycaeus giesbrechti*, second antenna of female (after M. Dahl).
 FIG. 38. *Corycaeus lubbockii*, second antenna of female (after M. Dahl).
 FIG. 39. *Corycaeus minimus*, second antenna of female.
 FIG. 40. *Corycaeus dubius*, second antenna of female.
 FIG. 41. *Corycaeus speciosus*, second antenna of female.
 FIG. 42. *Corycaeus clausi*, second antenna of female.
 FIG. 43. *Corycaeus anglicus*, second antenna of female (after M. Dahl).
 FIG. 44. *Oncaea mediterranea*, maxilliped of female.
 FIG. 45. *Oncaea curvata*, maxilliped of female.
 FIG. 46. *Oncaea notopa*, maxilliped of female.
 FIG. 47. *Oncaea minuta*, maxilliped of female.
 FIG. 48. *Oncaea ornata*, maxilliped of female.
 FIG. 49. *Oncaea dentipes*, maxilliped of female.
 FIG. 50. *Corycaeus flaccus*, urosome, lateral view.
 FIG. 51. *Labidocera acuta*, fifth leg of female.
 FIG. 52. *Labidocera acutifrons*, fifth legs of female.
 FIG. 53. *Labidocera detruncata*, fifth leg of female.
 FIG. 54. *Lucicutia clausii*, fifth legs of male.
 FIG. 55. *Microcalanus pygmaeus*, fifth legs of male.
 FIG. 56. *Heterorhabdus papilliger*, right fifth leg of male.



FIGURES 33-56

FIGURES 57-70

- FIGS. 57-68. *Danodes plumata*, n. gen. and n. sp., female. Fig. 57, dorsal view; fig. 58, first antenna; fig. 59, second antenna and mandible; fig. 60, first maxilla; fig. 61, mouth tube; fig. 62, second maxilla and maxilliped; figs. 63-66, first, second, third, and fourth legs; fig. 67, ventral surface of urosome, showing fifth legs; fig. 68, dorsal surface of last two abdominal segments and caudal rami.
- FIG. 69. *Labidocera detruncata*, fifth legs of young male.
- FIG. 70. *Metridia lucens*, fifth legs of male.

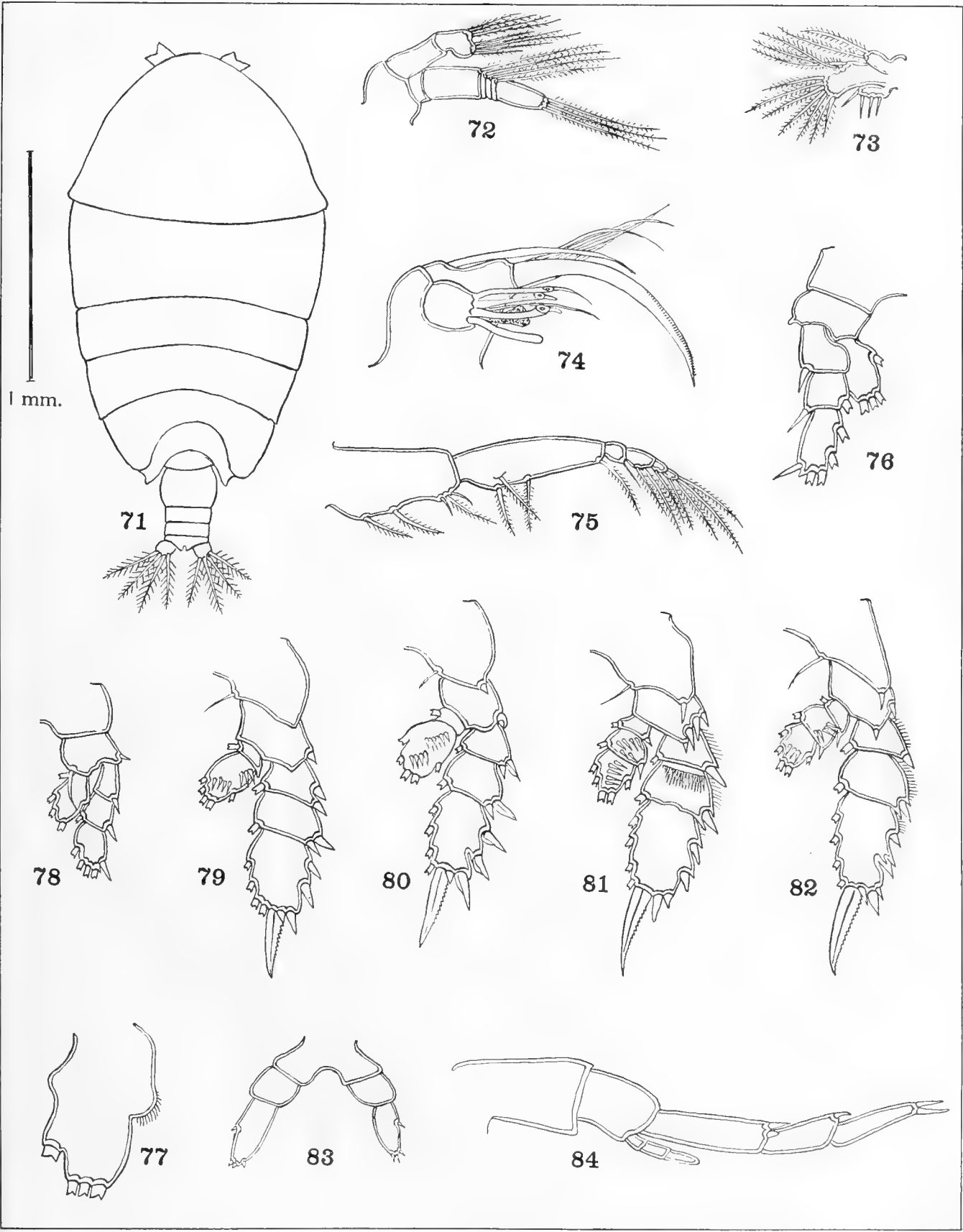


FIGURES 57-70

FIGURES 71-84

FIGS. 71-83. *Onchocalanus nudipes*, n. sp., female. Fig. 71, dorsal view; fig. 72, second antenna; fig. 73, first maxilla; fig. 74, second maxilla; fig. 75, maxilliped; fig. 76, first leg, normal; fig. 77, endopod of first leg, enlarged; fig. 78, first leg, another specimen; fig. 79, second leg, normal; fig. 80, second leg, another specimen; figs. 81, 82, third and fourth legs; fig. 83, fifth legs.

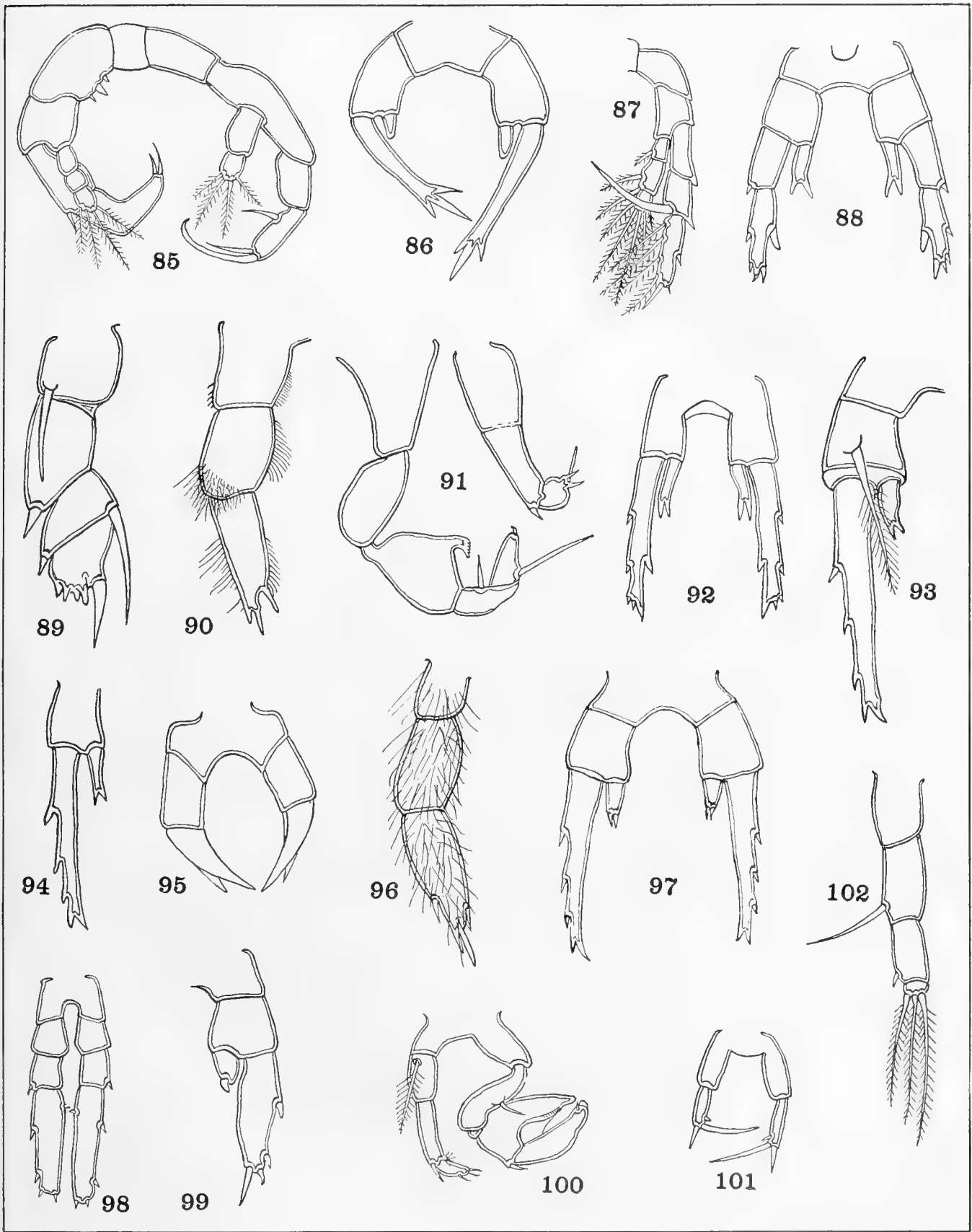
FIG. 84. *Neocalanus gracilis*, left fifth leg of male.



FIGURES 71-84

FIGURES 85-102

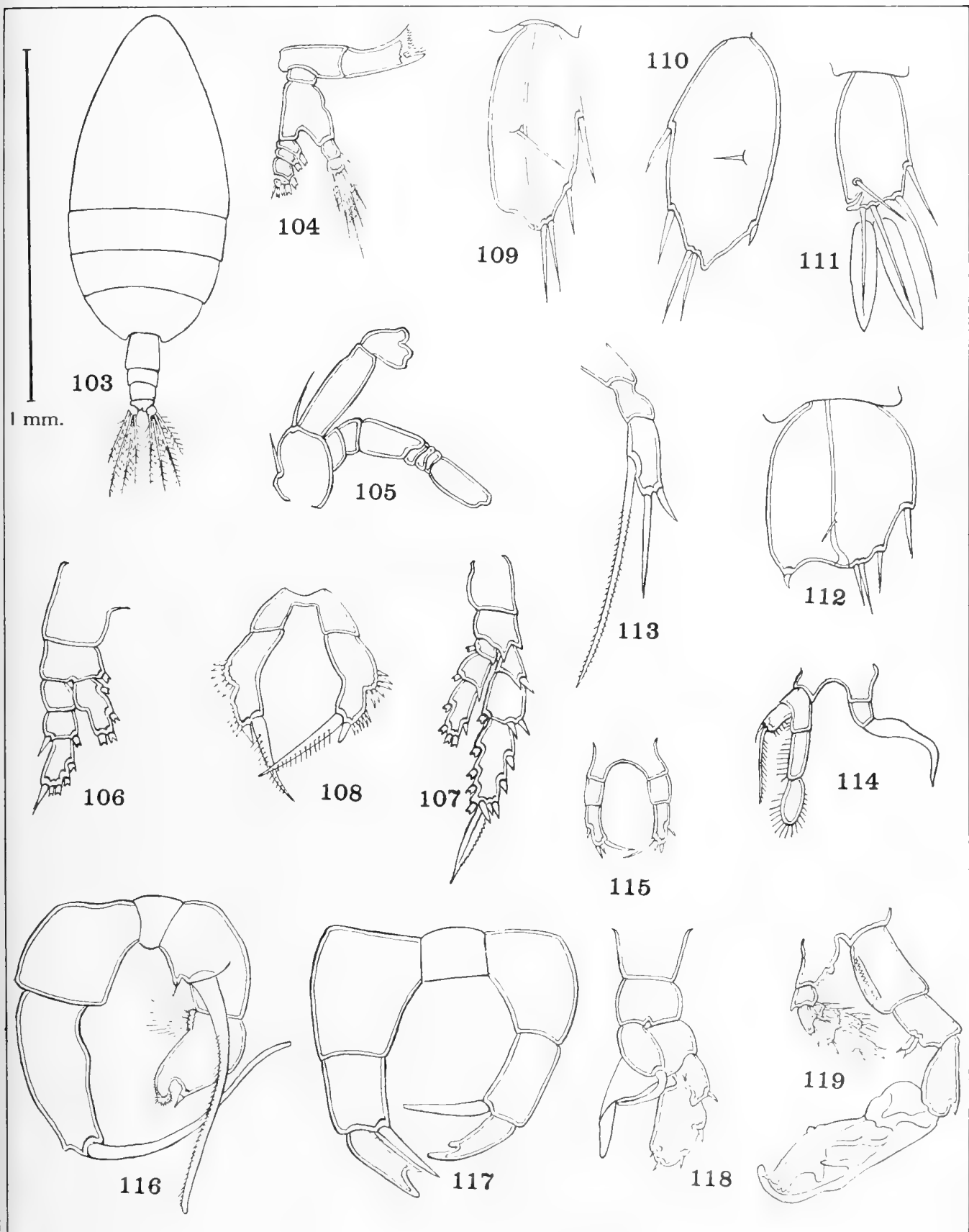
- FIG. 85. *Lucicutia curta*, fifth legs of male.
FIG. 86. *Labidocera nerii*, fifth legs of female.
FIG. 87. *Lucicutia grandis*, fifth leg of female.
FIG. 88. *Pontellopsis regalis*, fifth legs of adult female.
FIG. 89. *Phyllopus helgae*, fifth leg of female.
FIG. 90. *Onchocalanus cristatus*, fifth leg of female.
FIG. 91. *Pontellopsis villosa*, fifth legs of male.
FIG. 92. *Pontellopsis regalis*, fifth legs of young female.
FIG. 93. *Pontella tenuiremis*, fifth leg of female, anterior surface.
FIG. 94. *Pontella lobiancoi*, fifth leg of female.
FIG. 95. *Labidocera wollastoni*, fifth legs of female.
FIG. 96. *Onchocalanus trigoniceps*, fifth leg of female.
FIG. 97. *Pontella tenuiremis*, fifth legs of female, posterior surface.
FIG. 98. *Pleuromamma robusta*, fifth legs of female.
FIG. 99. *Pontellopsis perspicax*, fifth leg of female.
FIG. 100. *Pontellina plumata*, fifth legs of male.
FIG. 101. *Paracalanus aculeatus*, fifth legs of female.
FIG. 102. *Metridia princeps*, fifth leg of female.



FIGURES 85-102

FIGURES 103-119

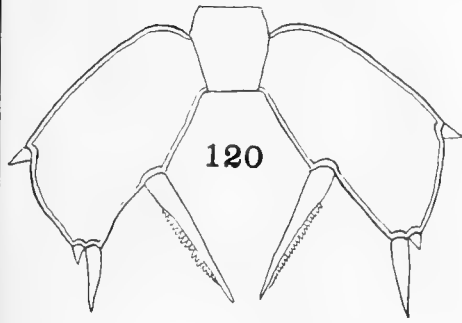
- FIGS. 103-108. *Scolecithricella spinacantha*, n. sp., female. Fig. 103, dorsal view; fig. 104, mandible and palp; fig. 105, second antenna; fig. 106, first leg; fig. 107, fourth leg; fig. 108, fifth legs.
- FIG. 109. *Sapphirina salpae*, caudal ramus.
- FIG. 110. *Sapphirina ovatolanceolata*, caudal ramus.
- FIG. 111. *Sapphirina metallina*, caudal ramus.
- FIG. 112. *Sapphirina opalina*, caudal ramus.
- FIG. 113. *Scaphocalanus elongatus*, fifth leg of female.
- FIG. 114. *Rhincalanus nasutus*, fifth legs of male.
- FIG. 115. *Temora discaudata*, fifth legs of female.
- FIG. 116. *Temoropia mayumbaensis*, fifth legs of male.
- FIG. 117. *Temoropia mayumbaensis*, fifth legs of female.
- FIG. 118. *Temora discaudata*, fifth legs of male.
- FIG. 119. *Undinula darwinii*, fifth legs of female.



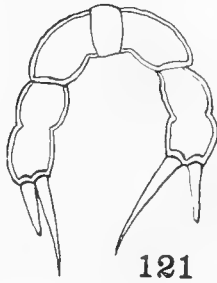
FIGURES 103-119

FIGURES 120-136

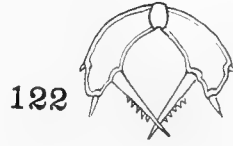
- FIG. 120. *Scolecithricella abyssalis*, fifth legs of female.
 FIG. 121. *Scolecithricella auropecten*, fifth legs of female.
 FIG. 122. *Scolecithricella marginata*, fifth legs of female, normal.
 FIG. 123. *Amallothrix propinqua*, fifth leg of male, abnormal.
 FIG. 124. *Scolecithricella minor*, fifth legs of young male.
 FIG. 125. *Scolecithricella ovata*, fifth leg of female.
 FIG. 126. *Scolecithricella minor*, fifth legs of adult male.
 FIG. 127. *Scolecithricella porrecta*, fifth legs of young male.
 FIG. 128. *Amallothrix obtusifrons*, fifth leg of female.
 FIG. 129. *Amallothrix valida*, fifth leg of female.
 FIG. 130. *Scolecithricella minor*, fifth leg of female.
 FIG. 131. *Amallothrix arcuata*, fifth leg of female.
 FIG. 132. *Scolecithricella abyssalis*, fifth leg of female, variant.
 FIG. 133. *Scolecithricella marginata*, fifth legs of female, abnormal.
 FIG. 134. *Scolecithricella porrecta*, fifth legs of female.
 FIG. 135. *Undinopsis bradyi*, fifth leg of male.
 FIG. 136. *Scaphocalanus medius*, fifth legs of female.



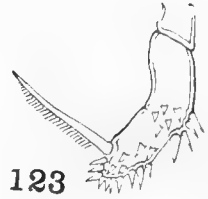
120



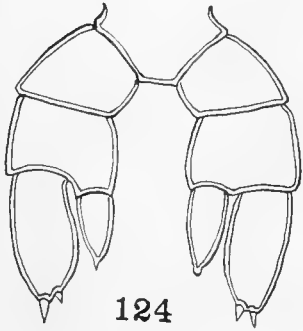
121



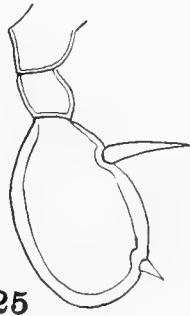
122



123



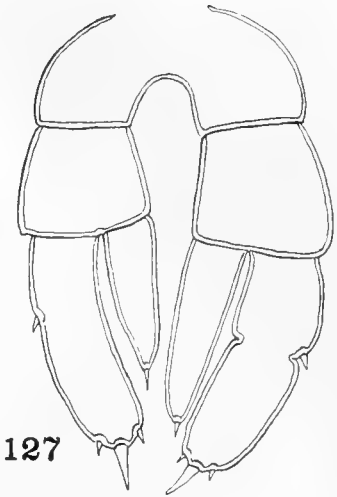
124



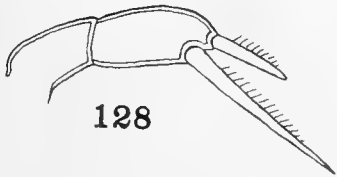
125



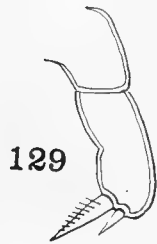
126



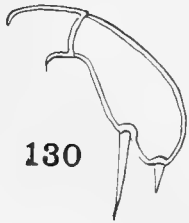
127



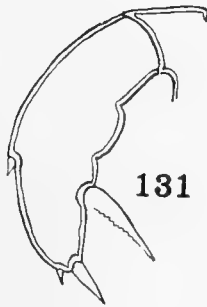
128



129



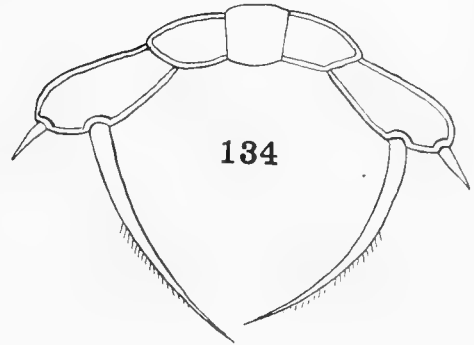
130



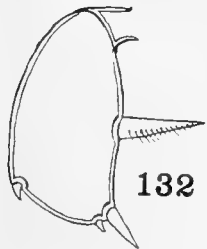
131



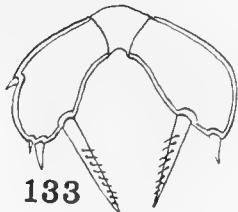
135



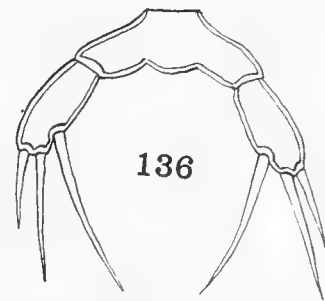
134



132



133



136

FIGURES 120-136



INDEX

[This index covers the species and synonyms in the "Discussion of Species," pages 169-210. Genera of synonyms are italicized.]

- abbreviatus, *Pachyptilus*, 200
 Pontoptilus, 200
 abdominalis, *Diaptomus*, 202
 Pleuromamma, 202
 abyssalis, *Heterochaeta*, 189
 Heterorhabdus, 189
 Scolecithricella, 207
 Scolecithrix, 207
 Spinocalanus, 209
 aculeata, *Lubbockia*, 191, 192
 aculeatus, *Paracalanus*, 201
 acuta, *Euchaeta*, 185
 Labidocera, 190
 Pontella, 190
 Pontellina, 190
 acutifrons, *Eutерpe*, 186
 Euterpina, 186
 Haloptilus, 188
 Harpacticus, 186
 Hemicalanus, 188
 Labidocera, 190, 191
 Pontella, 191
 Pontellina, 191
 aethiopica, *Candacia*, 174
 affinis, *Gaidius*, 188
 agilis, *Corycaeus*, 179, 180
 americana, *Calanopia*, 172
 andrewsi, *Corycaeus*, 179, 180
 anglica, *Oncaea*, 197
 anglicus, *Corycaeus*, 180
 angusta, *Sapphirina*, 205
 angusticeps, *Haloptilus*, 188
 arcuata, *Amallothrix*, 171
 Scolecithricella, 171
 arcuicornis, *Calanus*, 178
 Clausocalanus, 178
 ariommus, *Dysgamus*, 183
 armata, *Candace*, 174
 Candacia, 174
 Pontellopsis, 204
 armatus, *Actideus*, 170
 Monops, 204
 Pseudocalanus, 170
 armiger, *Gaetanus*, 187
 atlantica, *Oithona*, 197
 Pontella, 203
 Pontia, 203
 atlanticus, *Dysgamus*, 183
 attenuata, *Oithona*, 195, 196
 attenuatus, *Calanus*, 184
 Eucalanus, 184
 auronitens, *Sapphirina*, 205
 auropecten, *Scolecithricella*, 207
 Scolecithrix, 207

 bicornuta, *Lucicutia*, 192
 bipinnata, *Candace*, 174
 Candacia, 174
 bispinosa, *Candace*, 174
 Candacia, 174
 bradyi, *Actideus*, 183
 Euaetideus, 183
 Scolecithricella, 207
 Scolecithrix, 207
 Undinopsis, 210
 brevicauda, *Metridia*, 193
 brevicornis, *Oithona*, 195, 196
 brevis, *Euchirella*, 185
 brevispinus, *Gaidius*, 188

 calanina, *Cyclopsina*, 177
 calanius, *Centropages*, 177
 carinata, *Farranula*, 186, 187
 carinatus, *Corycaeus*, 186
 caroli, *Calanus*, 210
 Undinula, 210
 catula, *Candace*, 174
 Candacia, 174
 catus, *Corycaeus*, 180
 caudatus, *Spinocalanus*, 209
 chierchiaie, *Centropages*, 177
 clausi, *Corycaeus*, 180
 Mecynocera, 193
 clausii, *Acartia*, 169
 Leuckartia, 192
 Lucicutia, 192
 compactus, *Heterorhabdus*, 190
 concinna, *Farranula*, 186
 concinnus, *Corycaeus*, 186
 conifera, *Oncaea*, 197, 198
 cornutus, *Rhincalanus*, 205
 crassiusculus, *Corycaeus*, 180
 crassus, *Eucalanus*, 184
 cristata, *Pontella*, 203
 cristatus, *Calanus*, 172
 Onchocalanus, 199, 200
 Xanthocalanus, 199
 curta, *Candace*, 174
 Candacia, 174
 Corycella, 187
 Farranula, 186, 187
 Lucicutia, 192
 Oncaea, 197, 198
 curticauda, *Euchirella*, 185
 Metridia, 194
 curticaudis, *Specilligus*, 195
 curvata, *Oncaea*, 197, 198

 danae, *Acartia*, 169
 Pontella, 203
 Scolecithrix, 209
 Undina, 209
 darwinii, *Sapphirina*, 205, 206
 Undina, 210
 Undinula, 210
 denticulata, *Copilia*, 179
 dentipes, *Oncaea*, 197, 198
 detruncata, *Labidocera*, 190, 191
 Pontella, 191
 Pontellina, 191
 discaudata, *Temora*, 209
 divaricata, *Gaidius*, 205
 Pseudochirella, 205
 dubia, *Amallophora*, 189
 Heteramalla, 189
 dubius, *Corycaeus*, 180

 efferata, *Miracia*, 194
 elliptica, *Calanopia*, 172
 Pontella, 172
 elongatus, *Calanus*, 184
 Centropages, 177
 Eucalanus, 184
 Scaphocalanus, 207
 ethiopica, *Candacia*, 174

 falcifera, *Candacia*, 174, 175
 fallax, *Oithona*, 195, 196
 filigerus, *Euaugaptilus*, 184
 Hemicalanus, 184
 finmarchicus, *Calanus*, 171, 172
 Monoculus, 172
 flaccus, *Corycaeus*, 180, 181
 flavicornis, *Leuckartia*, 192
 Lucicutia, 192
 frontalis, *Lophothrix*, 191
 furcata, *Catopia*, 177
 furcatus, *Centropages*, 177
 Clausocalanus, 178
 Drepanopus, 178
 furcifer, *Corycaeus*, 180, 181

 gibber, *Acrocalanus*, 170
 gibbula, *Corycaeus*, 187
 Farranula, 186, 187
 giesbrechti, *Actideus*, 183
 Corycaeus, 180, 181
 Euaetideus, 183
 gracilis, *Acrocalanus*, 170
 Antaria, 178
 Calanus, 195
 Carnegiella, 176
 Conaea, 178
 Corycaeus, 187
 Farranula, 186, 187
 Macrosetella, 193
 Neocalanus, 195
 Pleuromamma, 202
 Pleuromma, 202
 Pseudocalanus, 204
 Setella, 193
 grandiremis, *Euchaeta*, 201
 Pareuchaeta, 201
 grandis, *Leuckartia*, 192
 Lucicutia, 192
 granulosa, *Corina*, 210
 Vetтория, 210

- hamata, *Ichthyophorba*, 177
hamatus, *Centropages*, 177
haswelli, *Euchaetopsis*, 185
hebes, *Euchaeta*, 185
 Oithona, 195, 196
helgae, *Phyllopus*, 202
helgolandicus, *Calanus*, 172
 Cetochilus, 172
humilifrons, *Lophothrix*, 191
hyperboreus, *Calanus*, 172, 173
- incisa, *Euchaeta*, 201
 Pareuchaeta, 201
inserta, *Monstrilla*, 195
intermedia, *Euchirella*, 185
- jousseauimei, *Ilyopsyllus*, 193
 Metis, 193
- kruppii, *Gaetanus*, 187
- latifrons, *Gaetanus*, 187
lautus, *Corycaeus*, 180, 181
leuckarti, *Cyclops*, 193
 Mesocyclops, 193
limbatus, *Corycaeus*, 180, 181
linearis, *Oithona*, 195, 196
lobiancoi, *Pontella*, 203
 Pontellina, 203
longa, *Metridia*, 194
longicaudatus, *Augaptilus*, 171
 Hemicalanus, 171
longicornis, *Acrocalanus*, 169, 170
 Cyclops, 209
 Haloptilus, 188
 Hemicalanus, 188
 Heterochaeta, 190
 Heterostylites, 190
 Leuckartia, 192
 Lucicutia, 192
 Macrocalanus, 193
 Megacalanus, 193
 Temora, 209
longifurcatus, *Dysgamus*, 183
longimana, *Candace*, 175
 Candacia, 174, 175
longiremis, *Acartia*, 169
 Dias, 169
longistylis, *Corycaeus*, 180, 181
longus, *Calanus*, 194
lubbockii, *Corycaeus*, 180, 181
 Monops, 204
 Pontellopsis, 204
lucens, *Metridia*, 194
- macroductyla, *Chiridiella*, 178
magna, *Amalophora*, 207
magnus, *Scaphocalanus*, 207
 Spinocalanus, 209
major, *Undeuchaeta*, 210
marginata, *Scolecithricella*, 207
 Scolecithrix, 207
marina, *Euchaeta*, 185
 marinus, *Cyclops*, 185
mayumbaensis, *Temoropia*, 209
media, *Amalophora*, 207
 Oncaea, 197, 198
mediterranea, *Oncaea*, 197, 198
medius, *Scaphocalanus*, 207
messinensis, *Euchirella*, 185
 Undina, 185
metallina, *Sapphirina*, 205, 206
miles, *Gaetanus*, 187
minimus, *Corycaeus*, 180, 181
minor, *Calanus*, 172, 173
 Cetochilus, 173
 Gaetanus, 188
 Scolecithricella, 207, 208
 Scolecithrix, 208
 Valdiviella, 210
minuta, *Oncaea*, 197, 198
minutus, *Calanus*, 205
 Pseudocalanus, 204, 205
mirabilis, *Copilia*, 179
monachus, *Acrocalanus*, 170
 Eucalanus, 184
mucronatus, *Eucalanus*, 184
- nana, *Oithona*, 197
 Oithonina, 197
nasutus, *Rhincalanus*, 205
negligens, *Acartia*, 169
nerii, *Labidocera*, 190, 191
 Pontia, 191
nigromaculata, *Sapphirina*, 205, 206
norvegica, *Candace*, 175
 Candacia, 174, 175
 Heterochaeta, 190
 Microsetella, 194
 Setella, 194
norvegicus, *Heterorhabdus*, 190
notopa, *Oncaea*, 197, 198
notopus, *Oncaea*, 198
nudipes, *Onchocalanus*, 199
- obtusifrons, *Amalophora*, 171
 Amalothrix, 171
 Scolecithricella, 171
oculata, *Macrosetella*, 193
 Setella, 193
opalina, *Sapphirina*, 205, 206
ornata, *Oncaea*, 197, 199
ornatus, *Haloptilus*, 188, 189
 Hemicalanus, 189
ovalis, *Corycaeus*, 180, 182
ovata, *Scolecithricella*, 208
 Scolecithrix, 208
ovatolanceolata, *Sapphirina*, 205, 206
oxycephalus, *Haloptilus*, 188, 189
 Hemicalanus, 189
- pachydactyla, *Candace*, 175
 Candacia, 174, 175
pacificus, *Corycaeus*, 180, 182
papilliger, *Heterorhabdus*, 189, 190
papilligera, *Heterochaeta*, 190
 parvus, *Calanus*, 201
 Paracalanus, 201
patersonii, *Anomalocera*, 171
pauper, *Calanus*, 176
 Canthocalanus, 176
pavo, *Calanus*, 173
 Calocalanus, 173
pectinata, *Candace*, 174
pectinatus, *Drepanopus*, 183
pennata, *Pontella*, 203
perspicax, *Pontella*, 204
 Pontellina, 204
 Pontellopsis, 204
plumata, *Danodes*, 182
 Pontella, 204
 Pontellina, 204
plumifera, *Oithona*, 195, 196
plumosa, *Undeuchaeta*, 210
 Undina, 210
plumosus, *Haloptilus*, 188, 189
 Hemicalanus, 189
plumulosus, *Calanus*, 173
 Calocalanus, 173
poppei, *Chiridiella*, 178
porrecta, *Scolecithricella*, 208
 Scolecithrix, 208
princeps, *Calanus*, 193
 Megacalanus, 193
 Metridia, 194
 Pontella, 203
propinqua, *Amalothrix*, 171
 Scolecithricella, 171
propinquus, *Calanus*, 172, 173
pulchra, *Euchirella*, 186
 Undina, 186
pumilus, *Corycaeus*, 180, 182
punctata, *Pachysoma*, 200
punctatum, *Pachos*, 200
pusillus, *Microcalanus*, 194
pygmaeus, *Calanus*, 201
 Microcalanus, 194
 Paracalanus, 201
 Pseudocalanus, 194
pyrosomatis, *Sapphirina*, 205, 206
- quadrata, *Copilia*, 179
quadrangulata, *Pleuromamma*, 202
quadrangulatum, *Pleuromma*, 202
- rattrayi, *Augaptilus*, 176
 Centraugaptilus, 176
recta, *Copilia*, 179
regalis, *Pontella*, 204
 Pontellina, 204
 Pontellopsis, 204
rigidus, *Bathycalanus*, 172
robusta, *Oithona*, 195, 196
 Pleuromamma, 202
robustior, *Calanus*, 195
 Neocalanus, 195
robustum, *Pleuromma*, 202
robustus, *Corycaeus*, 180, 182
rosea, *Microsetella*, 194

- roseus, *Canthôcampus*, 194
 rostrata, *Clytemnestra*, 178
 Euchirella, 186
 Farranula, 186, 187
 Undina, 186
 rostratus, *Corycaeus*, 187
 Goniopsyllus, 178

 salpae, *Sapphirina*, 205, 206
 satyrus, *Pandarus*, 200
 scarlata, *Sapphirina*, 206
 scutellata, *Clytemnestra*, 178
 securifer, *Pontella*, 203
 setiger, *Oithona*, 195, 196
 setosus, *Arietellus*, 171
 similis, *Oithona*, 195, 196, 197, 199, 205
 Oncaea, 197, 199
 simplex, *Candace*, 175
 Candacia, 174, 175
 sinuatus, *Pandarus*, 201
 speciosus, *Corycaeus*, 180, 182
 spinacantha, *Scolecithricella*, 208
 spiniceps, *Haloptilus*, 188, 189
 Hemicalanus, 189
 spinifera, *Phaenna*, 202
 spinifrons, *Heterochaeta*, 190
 Heterorhabdus, 190
 spinirostris, *Oithona*, 195, 197
 spinosa, *Euchaeta*, 185
 spinulosus, *Aegisthus*, 170

 squillimana, *Lubbockia*, 191, 192
 stellata, *Sapphirina*, 206
 stylifer, *Calanus*, 209
 stylifera, *Temora*, 209
 styliremis, *Calocalanus*, 173
 subtenuis, *Eucalanus*, 184
 subtilis, *Oncaea*, 197, 199

 tenella, *Oncaea*, 197, 199
 tenuicornis, *Calanus*, 195
 Neocalanus, 195
 tenuimana, *Candace*, 175
 Candacia, 174, 175
 tenuiremis, *Pontella*, 203, 204
 tenuispinus, *Chiridius*, 188
 Gaidius, 188
 tonsa, *Euchaeta*, 201
 Pareuchaeta, 201
 tonsus, *Calanus*, 172, 173
 trigoniceps, *Onchocalanus*, 200
 truncata, *Candace*, 175
 Candacia, 174, 175
 tuberosum, *Pachos*, 200
 Pachysoma, 200
 tumidula, *Euchaeta*, 201
 Pareuchaeta, 201
 typica, *Amalophora*, 170
 typicus, *Agetus*, 182
 Centropages, 177
 Corycaeus, 180, 182

 unidentified species:
 Chiridella, 178
 Euchaetopsis?, 185
 Nesippus, 195
 Pennella, 202

 valida, *Amalothrix*, 171
 Scolecithrix, 171
 varians, *Pennella*, 202
 varicans, *Candace*, 175
 Candacia, 174, 175
 venusta, *Oncaea*, 197, 199
 venustus, *Corycaeus*, 180
 villosa, *Pontellopsis*, 204
 violacea, *Ichthyophorba*, 177
 violaceus, *Centropages*, 177
 vitrea, *Copilia*, 179
 vitreum, *Hyalophyllum*, 179
 vivida, *Oithona*, 195, 197
 vulgaris, *Undina*, 210
 Undinula, 210

 wollastoni, *Labidocera*, 190, 191
 Pontella, 191

 xiphias, *Pleuromamma*, 202
 Pleuromma, 202

 zyganae, *Pandarus*, 200

